1915. № 66.

ИЗВѢСТІЯ
НИКОЛАЕВСКОЙ ГЛАВНОЙ АСТРОНОМИЧЕСКОЙ ОБСЕРВАТОРІИ.
Томъ VI, 6.

BULLETIN
DE L'OBSERVATOIRE CENTRAL NICOLAS À POULKOVO.
Vol. VI, 6.

A Method to determine the astronomical Flexure in all zenithdistances.

By Ilmari Bonsdorff.

It is a remarkable fact that the efforts to invent reliable and appropriate methods for determining the astronomical flexure of meridian telescopes have been, less successful than to afford methods to eliminate other instrumental errors, vitiating the results of meridian observations. The discrepancies between the several systems of declinations of stars depend, no doubt, partly upon imperfect knowledge of the flexure of the tube.

The method generally employed by astronomers is that of determining the horizontal flexure by means of collimators, placed horizontally or directed on each other, the line of sight passing approximately through the rotation axis of the instrument. Against this method there are grave objections:

1. The method is effective solely in case that the flexure varies as the sine of the zenith distance.

2. Even if the flexure follows this simple law, the difficulties in determining the horizontal flexure are almost unsurmountable. It is feasible only under exceptionally favourable circumstances, which generally escape control. The layers of equal density of the air, through which the rays pass from one collimator to the other, must be horizontal, otherwise the refraction makes the determination illusory.

My experiences during the last years in determining the horizontal flexure by means of collimators led to the conclusion that this method is futile. The experiments were varied in a great many ways and made in different observing rooms,

but no results of high precision corresponding to the qualities of the investigated instruments (Ertel's and Repsold's vertical circles) could be obtained.

The method of interchanging objective and ocular, as proposed by Repsold, is useful only if we can suppose that the flexure is really eliminated in this way.

It is not necessary to enter into a critic on the method founded on direct and reflected observations of stars, as it is well known what a considerable time is wasted on such observations and how difficult it is to take into account the refractive influence on the track of the reflected rays.

Also there have been made attempts to determine the flexure of the telescope with the aid of special apparatuses attachable to the instrument.

For this purpose Marth suggested to fix a system of lenses and mirrors in the cube of the telescope and to mark a point on the objective. It is possible to determine the flexure by measuring in different zenith distances the distance between the mark and the reflected images of the wires[1]). The method, it seems, has found no application.

According to the same principle Loewy constructed an apparatus somewhat better fitted for the purpose. By means of it he determined the flexure of the Paris meridian circle[2]). But as this apparatus has to be removed for star observations and as the remounting and regulation of it give much trouble, this method has not been generally adopted.

The apparatus proposed by Bauschinger is based on an entirely different principle. A strong iron frame, supposed to be perfectly rigid, is attached to the cube of the telescope. The distances of the frame from the objective and the ocular are directly measured in different zenith distances[3]). As far as I am aware this apparatus has never been applied to first-class instruments.

In view of this unsatisfactory state of the question, how to determine the astronomical flexure, I endeavoured to solve the problem in the possibly simplest way, i. e. to find out means to determine the flexure completely in every zenith distance by an apparatus, attached only to the exterior of the cube and having no other contact with the instrument. The apparatus should be easily handled and its application in no way intrude on the current observations. I succeeded, so far as I can see, in solving the problem so stated. According to my drawings the apparatus was constructed on command of the Direction of the Pulkovo observatory by the mechanician, Mr. Messer, in the mechanical workshop of the observatory. Here follows the description of the apparatus and its application.

The essential parts of the apparatus are two steel tubes of 50 mm in diameter and $1\frac{1}{2}$ mm in thickness and $1^{m}.8$ in length. The tubes are fastened as solidly as

1) A. N. 57.

2) Annales d'Observatoire de Paris. Vol. 16.

3) Bauschinger, Biegung von Meridianfernrohren. München. 1888.

possible to the cube, the one beneath and the other above the telescope and are parallel to it (Fig. 1). To the object end of each of the two tubes a horizontal cylinder of steel *a* of 20 mm in diameter and 30 mm in length is attached (Fig. 2 natural size). These cylinders are well fitted to the bearings of brass fixed at the ends of an aluminium plate *c*. The plate with a transverse section in the form of a **T** is arranged in front of the objective and is perpendicular to the optical axis of the telescope. By means of four spiral springs *f* the rectangular bearings *b* are pressed against the cylinders *a*. Four ends of the spiral springs are fixed to the ends of the cylinders, the other four to the bearings. A metallic mirror *d* of 50 mm in diameter in a brass mounting is fixed to the aluminium plate opposite the centre of the objective. The mirror is pressed by the springs *g* against the three screws *e*. With these screws the position of the mirror is regulated.

The eye-ends of the tubes serve as a counterpoise to the other ends. As counterpoise for the aluminium plate and the mirror leaden weights are attached to the eye-ends of the tubes.

When stars are observed, the plate is removed and substituted by a counterpoise of the same weight. The apparatus with its auxiliary parts weighs 9 kilograms.

With the aid of this apparatus the flexure of the telescope is determined. The horizontal single wire of the ocular micrometer is in different zenith distances brought upon the reflected image of the double wire. It is necessary that the angle, formed by the surface of the mirror and an invariable plane passing through the cube, remains constant in every zenith distance. Thus the unavoidable flexure of the two steel tubes ought not to produce any rotation of the mirror about its horizontal axis. On the other hand a slight displacement of a plane mirror, if it but remain parallel to itself, would have no influence on the determination of the flexure. Owing to the flexure of the steel tubes the mirror is lowered, the telescope being in its horizontal position, by 0.3 mm and approaches the objective by 0.001 mm. If both the tubes have the same flexure, it is evident that the mirror is not subject to any rotation.

This supposition must be very nearly correct, firstly, because both the tubes cut from the same piece are perfectly alike, and secondly, because the distance between the two tubes cannot vary, their ends being joined by the aluminium plate. Nevertheless it is necessary to control the position of the mirror by direct experiments.

That is easily attained by attaching different weights to the ends of the tubes and observing the reflected image with the micrometer. If the micrometer readings are found to be variable, the tubes being differently charged, it would be proved that the mirror has undergone a slight rotation. Then to eliminate the resulting error, it would be necessary to repeat the determinations of the flexure after changing the steel tubes. Special measurements executed for the examination of this circumstance have shown that even if the weight was being gradually increased up to

5 kilograms, a sensible influence could not be noticed. Thus it was not necessary to change the tubes, as the rotation of the mirror, if existing at all, would change the value of the flexure by less than $0''.005$.

In spring and summer 1914, kindly assisted by Mr. Dneprowsky, I have made several determinations of the flexure with this apparatus. I should not like to regard the measurements as being definite, because some parts of the apparatus still need further improvement. But even in its present state, the apparatus meets very high demands to precision. An ocular of Bohnenberger with magnifying power of 100 was used for the measurements. The wires were illuminated by a small 4-Volt lamp. The pointings of the reflected image of the double thread with the single thread could be executed with great precision. The mean error of an observation amounted only to $\pm 0''.08$. The angular value of the micrometer screw is $1^r = 26''.40$. The flexure was determined for the zenith distances 90°, 75°, 60°, 45°, 30° and 15° as follows: The telescope was first brought in —90° zenith distance and two observations of the reflected image were made. Proceeding to the zenith distance + 90° four observations were made, followed by two more again in $z = -90''$. Precisely the same order was observed for all other zenith distances. The observation series for 6 zenith distances requires altogether half an hour. In order to protect the apparatus from changes of temperature during the measurements, it was covered with a piece of cloth. The lamp at the ocular was lit always 10^m before the measurements were begun. The observations were taken very quickly to prevent the temperature of the observer to influence the tubes.

The perfect working of the apparatus demands that the cylinders *a* and the bearings *b* should be smooth and well polished. As this was not the case with our apparatus, we were obliged to cover the cylinders with thin tin-foil in order to remove undesirable friction.

The following table contains the results of our measurements. The sign + preceeding the values of the flexure means a positive correction to the observed zenith distances, i. e. the flexure of the object end of the tube is greater than that of the eye-end.

Circle	Reading	Circle	Reading	Δ	Flexure
May 15. Pos. I. Observer *B*.					
75°	$2^r.232$	285°	$2^r.262$	$-0^r.030$	$-0''.40$
60	.240	300	.266	.026	.35
45	.249	315	.272	.023	.30
30	.245	330	.260	.015	.20
15	.251	345	.255	.004	.05
May 15. Pos. I. Observer *D*.					
75	2.205	285	2.234	−0.029	−0.38
45	.213	315	.236	.023	.30

Circle	Reading	Circle	Reading	Δ	Flexure
June 20. Pos. II. Observer *B*.					
270°	$2^r.422$	90°	$2^r.393$	$+0^r.029$	$+0''.38$
255	.448	105	.424	24	.32
240	462	120	.434	28	.37
225	.471	135	.458	13	.17
210	.473	150	.462	11	.15
195	.480	165	.473	7	.09

Circle	Reading	Circle	Reading	Δ	Flexure
June 20. Pos. II. Observer *B*.					
195°	2^{r}480	165°	2^{r}483	—0^{r}003	—0″04
210	.488	150	.470	+ 18	+ .24
225	.483	135	.464	19	.25
240	.482	120	.454	28	.37
255	.477	105	.446	31	.41
270	.460	90	.430	30	.40
June 20. Pos. II. Observer *D*.					
270	2 328	90	2.297	+0.031	+0.41
255	.334	105	.304	30	.40
240	.345	120	.318	27	.36
225	.352	135	.330	22	.29
210	.354	150	.338	16	.21
195	.356	165	.350	6	.08
June 20. Pos. II. Observer *D*.					
195	2.364	165	2.351	+0.013	+0.17
210	.362	150	.341	21	.28
225	.364	135	.338	26	.34
240	.361	120	.328	33	.43
255	.351	105	.319	32	.42
270	.341	90	.310	31	.41

Circle	Reading	Circle	Reading	Δ	Flexure
July 15. Pos. II. Observer *D*.					
270°	2^{r}559	90°	2^{r}527	+0^{r}032	+0″42
255	.564	105	.532	32	.42
240	.571	120	.550	21	.28
225	.589	135	.568	21	.28
210	.581	150	.558	23	.30
195	.595	165	.585	10	.13
July 15. Pos. II. Observer *D*.					
195	2.601	165	2.594	+0.007	+0.09
210	.584	150	.570	14	.18
225	.591	135	.561	30	.39
240	.578	120	.549	29	.38
255	.571	105	.532	39	.51
270	.558	90	.523	35	.46

The means of the directly observed values of flexure in the two positions are given in the following table:

Z.	Pos. I.	Pos. II.	Calc.
90°	—	+0″41	0″40
75	—0″39	+0.41	0.40
60	—0.35	+0.36	0.35
45	—0.30	+0.29	0.29
30	—0.20	+0.23	0.20
15	—0.05	+0.09	0.10.

From the agreement of the individual observations we find the mean error for one observation to be ± 0″05.

It is evident that the absolute value of the flexure is the same in the two positions and is thus perfectly eliminated by interchanging the objective and the ocular.

The flexure varies precisely as the sine of the zenith distance. The above values denoted by Calc. have been calculated from the expression 0″405 sin *z* which is deduced from the observations of the stars.

Pulkovo.
November, 1914.

† Th. Wittram.

Dr. Th. Wittram, Astronomer at the Central Astronomical Observatory Nicholas in Pulkovo and Professor at the Imperial Military Academy in Petrograd died suddenly Jan. 5. 1915 (Dec. 23. 1914).

He was born at Riga Sept. 29. 1854. After his studies at the University of Jurjev (Dorpat) 1873—1877 which conferred upon him the degree of a Magister and later on that of a Doctor of Astronomy, he entered as astronomer into the Observatory 1878 and afterwards passed all the gradations of an official astronomer. During the years 1878—1885 he worked in all departments of astrometry, and found also leisure to occupy himself with celestial Mechanics. In 1885 he definitely decided himself for Geodesy, and 1886 he was nominated Professor of the Imperial Military Academy, his function being to conduct the practical exercises of the future geodesists. He possessed remarkable talents as a Professor and was in great favour with his numerous disciples who have, most of them, become distinguished Geodesists. He was, moreover, Astronomer Councillor of the Geodetic Survey of the General Staff and of the Hydrographic Department.

Wittrams extensive knowledge made him a very valuable collaborator in different parts of astronomy, and he was always ready to execute scientific works demanded by the Observatory. A numerous collection of papers on different subjects bear witness of his activity. Among these papers we remind of his researches on the perturbations of the small planets and the Comet Encke by Jupiter, his computation of the geodetical net on Spitzberg, the reduction of the observations of the transit of Venus 1874 etc. He took active part in the determination of the difference of the longitude between Potsdam and Pulkovo, 1901. He was an enthusiastic collaborator in the introduction of the time-signals by radiotelegraph and an energetic member of the staff of astronomers, charged with the determination of the longitude between Paris and Pulkowo.

Wittram had a refined education, his talents in fine arts, and his amiable character made him a sociable man and beloved comrade. His death signifies a great loss to his colleagues and the Observatory.

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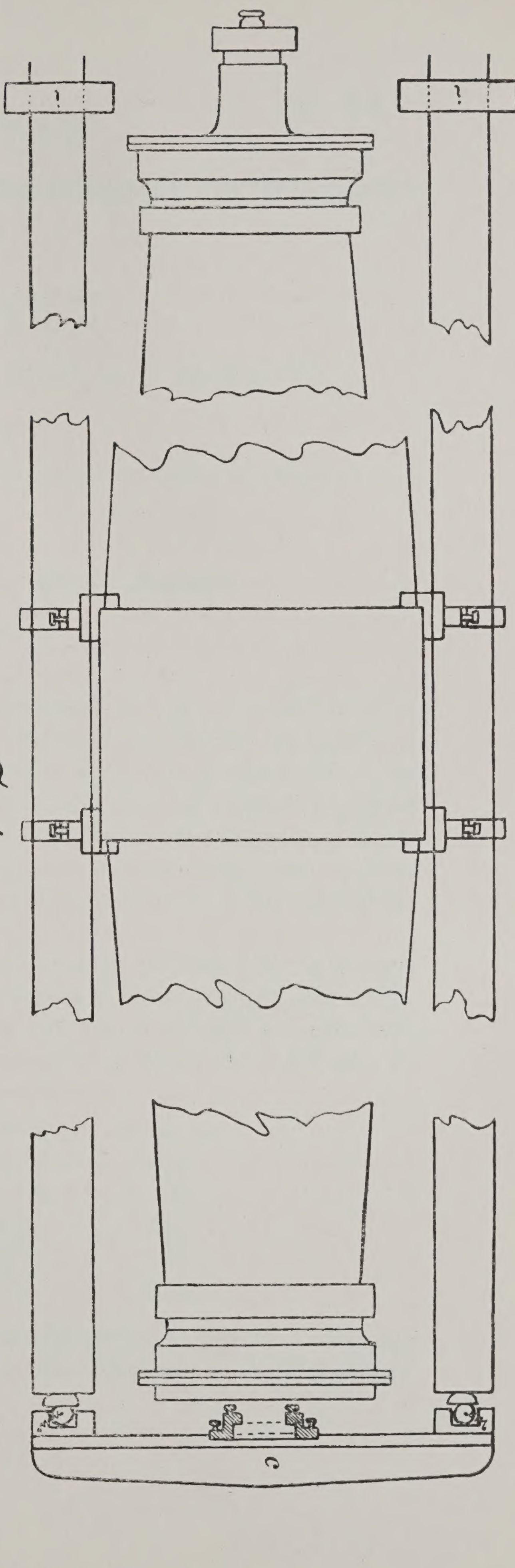

Fig 1.

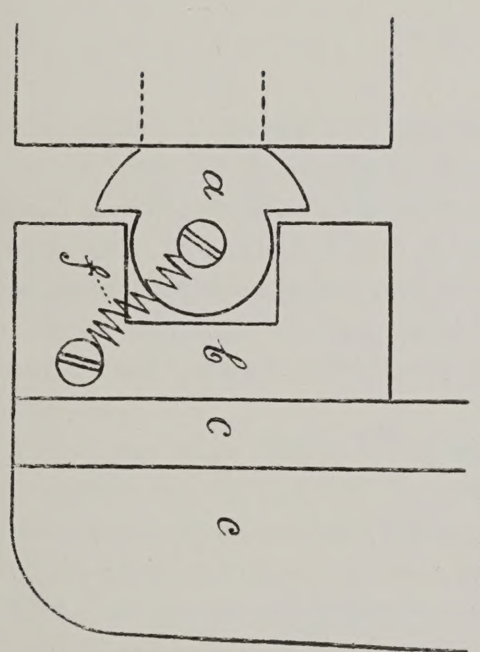

Fig 2.

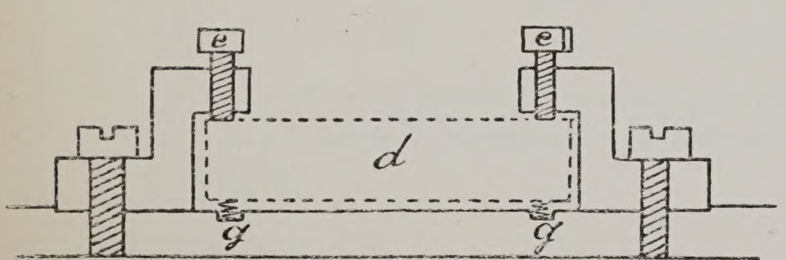

Fig. 3.

1915. № 67.

ИЗВѢСТІЯ
НИКОЛАЕВСКОЙ ГЛАВНОЙ АСТРОНОМИЧЕСКОЙ ОБСЕРВАТОРІИ.
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Sur l'étoile variable *RV* Ursae Majoris.

Par S. Beljawsky.

Les étoiles à variation d'éclat rapide constituent un objet à la fois facile et interessant pour la photographie céleste. La durée de la variation qui parfois ne dépasse pas 12^h, permet à l'observateur d'obtenir toutes les phases de la courbe d'éclat dans un temps très court. En général, si la période est bien connue, la somme des temps de pose nécessaires pour la construction de la courbe surpasse à peine la durée de la variation. D'autre part, les étoiles de ce type et précisement du type d'Antalgol sont connues seulement depuis une dizaine d'années et par conséquent peu étudiées.

J'ai exposé pour l'étoile *RV* Ursae Majoris 5 plaques contenant 10—20 images de la variable de 10 minutes de pose chacune. On a choisi près de la variable 5 étoiles de comparaison dont l'éclat doit être exprimé en système des grandeurs photographiques absolues par une comparaison avec la North Polar sequence de Pickering. Les étoiles de comparaison sont les suivantes:

№	α 1855.0	δ 1855.0	Gr. ph. abs.
3	$13^h28^m20^s$	+54°30′.0	10.95
5	29 20	55 4.5	11.10
1	BD. +54°.1610 (9.2)		9.37
2	BD. +55.1618 (9.1)		10.32
4	BD. +54.1611 (9.3)		10.40.

On a trouvé les grandeurs photographiques absolues de ces étoiles en exposant sur la même plaque la région de la variable et le Pôle Nord dans des conditions tout à fait égales.

Dans la table imprimée ci-dessous on a donné le temps d'observation héliocentrique en jours de la période Julienne. Les phases sont comptées à partir du maximum précédent calculé par la formule de M. Blajko:

$$\text{Max.} = 2417861.434 + 0^{d}.468058\,\varepsilon$$

Table I.

Date 1914	I. D. 242	Phase	Eclat Gr. ph. abs.
		d	m
Avril 15	0238.256	0.023	9.48
„	.263	.030	.53
„	.270	.037	.56
„	.277	.044	.65
„	.284	.051	.73
„	.291	.058	.78
„	.299	.066	.81
„	.306	.073	.85
„	.313	.080	.90
„	.320	.087	.92
„	.327	.094	.97
„	.334	.101	.98
„	.342	.109	10.10
„	.349	.116	.16
„	.356	.123	.24
„	.363	.130	.27
„	.370	.137	.33
„	.377	.144	.35
„	.384	.151	.38
Avril 25	0248.364	0.302	10.76
„	.370	.308	.74
„	.377	.315	.74
„	.385	.323	.77
„	.392	.330	.73
„	.399	.337	.74
„	.406	.344	.74
„	.414	.352	.75
„	.420	.358	.80
„	.427	.365	.80
„	.434	.372	.84
„	.442	.380	.84
„	.449	.387	.84
Juin 21	0305.320	0.155	10.39
„	.326	.161	.53
„	.333	.168	.52
Juin 21	0305.340	0.175	10.52
„	.348	.183	.57
„	.355	.190	.58
„	.362	.197	.63
„	.369	.204	.68
„	.376	.211	.75
„	.383	.218	.75
„	.390	.225	.80
„	.397	.232	.80
„	.405	.240	.82
Juin 25	0309.298	0.389	10.76
„	.305	.396	.84
„	.312	.403	.82
„	.319	.410	.76
„	.327	.418	.84
„	.334	.425	.76
„	.341	.432	.68
„	.348	.439	.71
„	.355	.446	.60
„	.362	.453	.26
„	.369	.460	.10
„	.376	.467	.00
„	.383	.006	9.73
Déc. 26	0493.552	0.228	10.64
„	.559	.235	.67
„	.566	.242	.73
„	.573	.249	.76
„	.580	.256	.75
„	.587	.263	.80
„	.594	.270	.80
„	.601	.277	.84
„	.609	.285	.85
„	.616	.292	.82
„	.623	.299	.80
„	.629	.305	.77

Table II.

Phase	Eclat	n	Phase	Eclat	n
d	m		d	m	
0.006	9.73	1	0.259	10.78	2
.023	.48	1	.274	.82	2
.033	.54	2	.287	.83	2
.047	.69	2	.302	.78	3
.062	.80	2	.312	.74	2
.076	.87	2	.327	.75	2
.090	.94	2	.340	.74	2
.105	10.04	2	.355	.77	2
.120	.20	2	.367	.82	2
.134	.30	2	.384	.84	2
.144	.38	1	.393	.80	2
.153	.39	2	.407	.79	2
.165	.52	2	.421	.80	2
.179	.55	2	.436	.70	2
.194	.61	2	.446	.60	1
.208	.72	2	.453	.26	1
.224	.73	3	.460	.10	1
.236	.74	3	.467	.00	1
.245	.75	2			

Pour construire la courbe d'éclat on a formé les lieux normaux en prenant la moyenne de 2 ou 3 observations voisines, sauf les observations au voisinage du maximum où la variation est tellement rapide que la formation des moyennes pourrait modifier la forme de la courbe.

Les lieux normaux sont donnés dans la table II.

Comme on voit de la courbe d'éclat la variation s'effectue dans les limites de $9^m.48$ à $10^m.84$. L'éclat croît pendant $0^d.105$; la marche de la branche ascendante est lente au commencement, mais s'accentue assez vite et atteint $1^m.15$ dans une heure. Le petit maximum à $0^d.325$ est assez remarquable. D'après les observations visuelles de M. Luizet l'amplitude de la variation est égale à $0^m.9$. L'amplitude photographique est par consequent 1.5 fois plus grande. L'éclat maximal étant à peu près le même, la coloration de l'étoile au minimum doit être de 1.5 type de Harvard plus foncée qu'au maximum.

Les étoiles jaunes et rouges sur les cartes du ciel de Wolf-Palisa.

Par S. Beljawsky.

Dans les recherches des petites planètes, entreprises depuis deux ans à la succursale de Simeïs, on a souvent à comparer les plaques photographiques obtenues pour ce travail avec les cartes du ciel de Wolf-Palisa. Au courant de ces comparaisons faites le plus souvent au moyen d'une loupe nous avons remarqué beaucoup d'étoiles qui sont ceteris paribus considérablement plus faibles sur les cartes de Wolf-Palisa que sur nos plaques. On en a cherché la cause et on a trouvé tout de suite que ces étoiles sont toujours de la couleur jaune ou rouge, c. à. d. du 2-e ou 3-e type spectral, si elles ne sont pas variables (ce qui est assez rare). Cette qualité des cartes de Wolf-Palisa est précieuse, parce qu'elle nous permet de déterminer à peu près le type des étoiles très faibles. La précision qu'on y peut atteindre dépend des moyens employés pour la comparaison des images stellaires: avec une simple loupe on ne peut discerner que le premier type du type second et peut être le second du troisième. Mais, si on se décide à mésurer les diamètres des images, la précision sera plus grande; à mon avis, on parviendra peut-être à discerner les types de Harvard *B*, *A*, *F* etc.

Dans une table qui suit je donne à titre d'exemple une petite série des étoiles du 2-e ou 3-e type spectral que j'ai trouvée par la comparaison des épreuves suivantes: pour la section de 2^h la carte Wolf-Palisa № 143 était comparée à la plaque de Simeïs de 1914 Oct. 24, $11^h59^m.9 - 12^h59^m.9$ t. m. de Gr.; la section de 0^h est le resultat d'une comparaison de Wolf-Palisa № 101 à la plaque de Simeïs de 1913 Juillet 4, $8^h53^m.6 - 10^h53^m.6$ t. m. de Gr. Pour le reste on a confronté la carte Wolf-Palisa № 179 avec une plaque de 1914 Juillet 10, $7^h31^m - 8^h22^m$ t. m. de Gr. Comme on voit dans la colonne des remarques 8 étoiles de la table se trouvent dans le P. D., dont 3 sont aussi dans le H. R. La coloration jaune de ces étoiles est confirmée dans 7 cas. L'étoile A. G. Lei 8574 (7.2) $= a$ désignée GW dans le P. D. doit être selon ce catalogue de $0^m.42$ plus brillante que l'étoile B. D. $+32^\circ.3984$ (7.3) $= b$, tandis que dans la carte de Wolf-Palisa № 179 „*a*“ est au moins de 2^m plus faible que „*b*“ et sur notre plaque „*a*“ est de $0^m.5$ plus faible que „*b*“. Chez Poph $a = 8.3$, $b = 8.0$. Si l'étoile „*a*“ est vraiment GW, elle doit être variable.

Table.

№	α 1875.0	δ 1875.0	Remarques.
1	$2^h32^m38^s$	$+17^\circ50'.6$	
2	34 42	16 12.0	Berl. A. 727 (9.0)
3	35 5	17 13.5	„ 728 (8.2)
4	36 41	17 1.0	„ 735 (7.5)

№	α 1875.0	δ 1875.0	Remarques.	
5	$2^h 38^m 46^s$	$+16^\circ 29'.5$	Berl. A.	742 (7.6)
6	40 34	19 20.6	„	752 (8.6)
7	40 45	16 46.6	„	753 (9.0)
8	41 0	20 4.3		
9	41 32	17 45.7	„	759 (7.0) M. K. G—, H. R. K.
10	41 35	16 35.5	„	760 (8.8)
11	43 14	19 58.5		
12	44 11	16 24.4	„	769 (9.2)
13	44 38	18 47.6	„	770 (8.7)
14	47 58	20 17.4	Berl. B.	855 (8.7)
15	48 47	17 49.4	Berl. A.	787 (7.0) M. K. G., HR. Mb 5.
16	50 54	17 18.6	„	792 (8.0) M. K. G—
17	51 41	20 5.6	„	798 (8.8)
18	52 32	18 14.7	„	805 (9.2)
19	0 26 55	39 11.7	Lu.	201 (8.6)
20	27 37	39 46.4		
21	28 16	40 41.0	Bo.	442 (8.0) M. K. WG.
22	28 50	41 6.1	Bo.	449 (8.8)
23	29 11	40 10.2		
24	30 45	40 24.2	„	474 (9.2)
25	30 48	40 43.9	„	476 (8.3)
26	31 1	42 1.5	„	480 (8.6)
27	31 53	39 45.0	Lu.	241 (8.7)
28	32 3	39 44.6	„	245 (8.8)
29	33 4	39 9.3		
30	33 21	38 45.2	„	253 (7.8)
31	33 52	41 13.4	Bo.	524 (9.0)
32	34 52	41 35.3		
33	35 4	39 37.4	Lu.	267 (9.0)
34	35 46	41 16.7	Bo.	548 (9.0)
35	36 30	38 46.8	Lu.	281 (8.8)
36	37 0	39 2.0		
37	37 48	39 59.7	Lu.	287 (6.8) M. K. WG+
38	38 7	39 0.1		
39	38 41	39 12.1	„	293 (8.8)
40	38 50	40 30.3	Bo.	586 (8.2)
41	39 3	39 34.1	Lu.	294 (8.5)
42	39 14	40 51.2	Bo.	594 (9.1)
43	39 48	38 56.3	Lu.	301 (8.6)
44	40 29	40 37.0	Bo.	620 (8.7)
45	40 51	40 36.3	„	627 (9.1)
46	41 0	39 56.1		
47	41 13	39 49.7		
48	41 26	40 54.8	„	636 (8.8)
49	41 42	39 6.0	Lu.	313 (9.0)
50	42 21	39 17.9		

№	α 1875.0	δ 1875.0		Remarques.
51	$0^h 43^m 34^s$	$+41° 3'.0$	Bo.	672 (8.8)
52	43 58	41 14.7	„	675 (8.6)
53	20 32 24	30 34.0	Lei.	8356 (8.0)
54	33 14	31 32.9	„	8377 (8.8)
55	35 33	32 0.0	„	8398 (9.0)
56	35 36	31 41.0		
57	36 27	30 53.4		
58	37 51	31 27.3	„	8429 (8.7)
59	40 7	31 19.3	„	8454 (8.0)
60	40 22	30 35.1	„	8456 (8.5)
61	41 13	31 30.8	„	8464 (8.8)
62	41 26	31 30.7	„	8467 (8.9)
63	41 53	32 52.4		
64	42 31	32 13.8	„	8485 (9.0)
65	42 37	30 10.7		
66	42 38	32 26.2	„	8487 (9.2)
67	43 28	30 20.0	„	8496 (7.5) M. K. WG+
68	43 37	31 31.2		
69	44 12	31 49.9	„	8505 (8.3)
70	44 25	30 11.2	„	8508 (8.1)
71	44 48	31 52.6		
72	45 2	31 44.2		
73	45 39	31 7.8	Lei.	8522 (9.1)
74	46 32	32 38.4	„	8529 (8.9)
75	47 10	30 51.3		
76	47 47	31 20.3	„	8543 (8.5)
77	47 59	32 41.3		
78	48 5	32 33.1	„	8549 (9.2)
79	48 7	31 53.2		
80	48 13	31 42.8		
81	48 37	31 38.0		
82	48 47	31 11.8		
83	48 50	32 57.8	„	8559 (6.0) M. K. G.; H. R. G.
84	49 16	31 39.2		
85	49 34	31 30.0		
86	49 59	32 38.5	„	8572 (8.7)
87	50 17	32 12.7	„	8574 (7.2) M. K. GW.
88	50 32	31 18.2		
89	50 43	31 37.0	„	8578 (7.6)
90	51 8	31 13.3		

Observations photographiques de la comète Encke faites à l'astrographe de Simeïs.

Par S. Beljawsky.

1914		T. m. de Gr.	Positions moyennes pour 1914.0 Objectif *A*		Objectif *B*	
Sept.	20	$11^h 19^m.1$	$3^h 50^m 14^s.95$	$+39°13'39''.3$	$3^h 50^m 14^s.77$	$+39°13'40''.8$
	21	10 50.1	52 51.42	45 20.0	52 51.28	45 18.4
Oct.	11	6 34.5	5 41 22.83	55 34 36.6	5 41 22.47	55 34 28.5
	16	13 16.1	7 6 26.38	60 31 25.6	7 6 26.95	60 31 26.1
	28	14 2.5	11 57 16.24	46 9 3.5	11 57 17.00	46 9 7.4

Remarques. Sept. 20. Durée de la pose: 2^h. La comète a l'aspect d'une nébulosité elliptique allongée vers le *NE*. La longueur du grand axe de l'ellipse est voisine de 100″. Le noyau très éxcentré, mais peu net, est produit par une forte condensation de la matière dans le quadrant *SW*. La grandeur du noyau est à peu près $13^m.5$.—Sept. 21. Durée de la pose: $1^h 50^m$. La comète est mal définie à cause des nuages qui interrompent plusieurs fois l'observation. C'est une nébulosité de 60″ de diamètre sans noyau apparent. — Oct. 11. L'épreuve du 11 Octobre était destinée pour une évaluation de la grandeur de la comète et contenait une image de 30^{mm} de pose avec la lunette pointée sur une étoile à côté d'une autre image de même temps de pose faite avec la lunette suivant la comète même. Ces images de la comète furent trouvées comme peu appropriées pour une photométrie de ce genre. — Oct. 16. Durée de la pose: 1^h. La comète présente la forme d'une nébulosité en éventail, de 200″ de diamètre un peu allongée vers le Soleil. La matière cométaire se condense peu à peu vers le *W.* jusqu'à atteindre le noyau de 12ᵉ gr. fort bien défini et placé tout à fait sur le bord de la nébulosité. On peut soupçonner deux émanations sortant du noyau et formant deux branches d'une parabole; l'axe de cette parabole est dirigé vers l'*E.* La parabole est entourée par une matière nébuleuse qui est un peu déplacée vers le côté *S.* — Oct. 28. Durée de la pose: 1^h. La nébulosité de la comète est presque ronde et de 300″ de diamètre. Elle se condense peu à peu vers le *NW.* Le noyau de 11 gr. est bien net et se trouve sur le bord au *NW.* Si on imagine un axe de symétrie de l'image cométaire passant par le noyau, il serait orienté du *NW* vers le *SE.* On soupçonne une large aigrette sortant du noyau et se dirigeant vers le point *N* de cet axe. C'était le premier jour que la comète était à la limite de la visibilité pour l'oeil nu. Il est remarquable que les émanations décrites dans ces remarques sont dirigées à peu près en avant par rapport au mouvement de la comète dans son orbite et font un angle aigu avec la direction vers le Soleil. On ne voit pas de vraie queue normale.

Observations de comètes à l'équatorial de 15 p.

Par L. Ocoulitch, B. Noumeroff et A. Wyssotsky.

1914	T. m. Poulk.	Δα	Δδ	Cp.	α app.	lg pΔ	δ app.	lg pΔ	Réd. au jour	*	Obs.
					Comète 1913 f (Delavan).						
Septembre 2	12h 1m 12s	— 0m 25s.68	+1′ 34″.6	38.10	8h 28m 59s.23	9.405n	+48° 57′ 45″.6	0.889	+2s.26; — 5.3	1	N.
3	8 46 27	— 2 50.51	—2 29.4	35.6	34 32.65	9.067n	49 7 43.6	0.914	+2.26; — 5.8	2	N.
5	11 42 28	— 1 19.88	+4 24.3	46.13	8 48 34.11	9.325n	49 29 16.0	0.898	+2.26; — 6.6	3	N.
8	9 3 17	+ 0 58.22	+1 17.3	31.10	9 8 32.91	9.055n	49 49 58.5	0.912	+2.24; — 7.8	4	N.
8	10 27 44	+ 1 22.83	+1 35.8	18.2	8 57.52	8.731n	49 50 17.0	0.917	+2.24; — 7.8	4	W.
9	15 18 43	+ 0 50.98	+1 5.9	39.10	17 34.00	9.654n	49 55 38.0	0.744	+2.22; — 8.3	5	N.
11	16 2 15	+ 0 49.79	+1 11.5	28.6	32 24.29	9.663n	49 59 51.9	0.699	+2.18; — 9.1	6	N.
13	9 5 10	— 1 9.70	—2 56.2	18.4	45 9.43	9.155	49 58 32.1	0.909	+2.13; — 9.8	7	W.
13	16 8 40	+ 1 3.60	—3 37.5	30.10	47 22.74	9.663n	49 57 50.8	0.700	+2.14; — 9.8	7	N.
14	12 50 19	—10 57.15	—0 47.2	18.2	9 53 54.62	9.444n	49 54 53.7	0.880	+2.04; —10.3	8	W.
16	10 33 18	— 5 2.19	+4 26.2	18.4	10 8 26.73	7.965n	49 43 57.1	0.918	+2.02; —10.8	9	W.
17	10 3 37	— 2 38.33	+4 4.5	18.4	15 58.67	8.757	49 35 50.7	0.917	+2.00; —11.1	10	W.
17	15 38 58	— 0 50.49	+1 55.6	28.10	17 46.52	9.647n	49 33 41.7	0.756	+2.01; —11.2	10	N.
20	9 32 38	— 0 53.77	+0 56.0	18.4	10 38 54.96	9.138	49 0 33.3	0.912	+1.91; —12.0	11	W.
23	12 50 46	+ 6 47.18	—2 28.4	18.4	11 2 55.24	9.374n	48 5 56.6	0.895	+1.86; —12.8	12	W.
26	10 24 27	— 1 10.92	—7 51.4	18.4	11 24 34.66	8.888	46 59 45.3	0.922	+1.70; —13.3	13	W.
Octobre 9	8 41 8	+ 0 22.43	—0 44.4	8.4	12 50 26.75	9.432	39 31 25.2	0.895	+1.39; —14.4	14	O.
10	7 32 18	+ 3 52.75	+4 21.1	18.4	55 54.61	9.520	38 51 3.4	0.862	+1.41; —14.6	15	W.
12	7 58 12	— 1 2.51	+1 36.2	18.4	13 7 5.45	9.494	37 23 19.8	0.875	+1.36; —14.5	16	O.
13	7 48 25	— 3 24.08	+7 25.3	18.4	12 24.19	9.503	36 39 15.1	0.870	+1.35; —14.4	17	O.
16	8 27 10	— 1 51.28	—7 58.4	18.4	27 47.89	9.444	34 22 6.9	0.894	+1.34; —14.5	18	O.
21	6 58 13	— 0 10.61	—4 11.9	8.6	13 50 34.50	9.519	+30 33 12.5	0.854	+1.33; —14.5	19	O.
					Comète 1914 d (Encke).						
Octobre 16	11 1 46	+ 0 42.52	+1 42.6	6.4	7 2 47.82	9.775n	+60 23 43.1	0.615	+5.59; — 9.2	20	O.
20	11 48 22	+ 5 26.11	—2 20.8	18.4	8 43 14.26	9.776n	61 22 56.7	0.667	+4.79; —18.3	21	W.

Positions moyennes des étoiles de comparaison.

*	α 1914.0	δ 1914.0	Autorité
1	8h 29m 22s.65	+48° 56′ 16″.3	B. D. +49° 1744. Comp. à A. G. Bonn 6662 par M. Wyssotsky le 30 janv. 1915.
2	8 37 20.90	+49 10 18.8	A. G. Bonn 6744 pr.
3	8 49 51.73	+49 24 58.3	„ „ „ 6837
4	9 7 32.45	+49 48 49.0	„ „ „ 6989
5	9 16 40.80	+49 54 40.4	39 Lynx (Boss 2512 mj.)
6	9 31 32.32	+49 58 49.5	A. G. Bonn 7194
7	9 46 17.00	+50 1 8.1	„ „ „ 7331
8	10 4 49.73	+49 55 51.9	„ „ „ 7483
9	10 13 26.90	+49 39 41.7	„ „ „ 7550
10	10 18 35.00	+49 31 57.3	„ „ „ 7590
11	10 39 46.82	+48 59 49 3	„ „ „ 7742
12	10 56 6.20	+48 8 37.8	„ „ „ 7858
13	11 25 43.88	+47 7 50.0	„ „ „ 8075
14	12 50 2.93	+39 32 24.0	„ „ Lund 5575
15	12 52 0.45	+38 46 56.9	α Chiens de chasse (Boss 3371)

*	α 1914.0	δ 1914.0	Autorité
16	$13^h\ 8^m\ 6^s.60$	$+37°21'58''.1$	A. G. Lund 5675
17	13 15 46.92	+36 32 4.2	„ „ „ 5725
18	13 29 37.83	+34 30 19.8	„ „ Leid. 4937
19	13 50 43.78	+30 37 38.9	„ „ „ 5041
20	7 1 59.71	+60 22 9.7	„ „ Hels. 4908
21	8 37 43.36	+61 25 35.8	„ „ „ 5661

N = Noumeroff
O = Ocoulitch
W = Wyssotsky.

Remarques. Comète 1913 f. Sept. 8, 13, 14, 16, 17, 20, 23, 26, Oct. 10. Noyau bien défini; les observations ont été faites avec des fils noirs et éclairage rouge du champ, grossissement 275 f. La tête de la comète a la forme d'un segment parabolique. L'éclat total de la tête, éstimé à l'aide d'une jumelle prismatique le 8 septembre, est égal à $4^m.6$. *Oct. 9.* Le noyau, observé au chercheur, a l'éclat de $5^m.0$. *Oct. 12.* Éclat du noyau — $4^m.7$ (comparé à A. G. Lund 5688). *Oct. 16.* Noyau de $5^m.0$. *Oct. 21.* Éclat du noyau — $5^m.0$; ciel brumeux.

Comète 1914 d. Oct. 16. La comète a la forme d'une nébulosité de $2'$ à $3'$ de diamètre. L'observation est assez pénible, la comète étant à peine visible avec un grossissement de 110 f. et des fils faiblement éclairés.

Oct. 20. Très faible et floue, le bord Ouest de la tête presente une condensation et possede une éspece de pointe, le bord Est s'élargit en éventail. Le diamètre est de $3'$ environ. On pointait la partie la plus condensée; l'observation avec des fils à peine éclairés est très pénible. Observée avec une jumelle prismatique (6 ×) la comète offre un éclat de 7^m.

Oct. 21. On est dans l'impossibilité de faire les pointés, la comète disparaissant au plus faible éclairage des fils. La forme ressemble beaucoup au dessin pris par Schwabe le 5 nov. 1838 et publié dans l'„Astronomie populaire" d'Arago t. II.

Le chronographe Hipp a été employé pendant toutes les observations, excepté celles de Sept. 2, 3 et 5 faites d'après la méthode „oeil-oreille".

Poulkovo.
Janvier, 1915.

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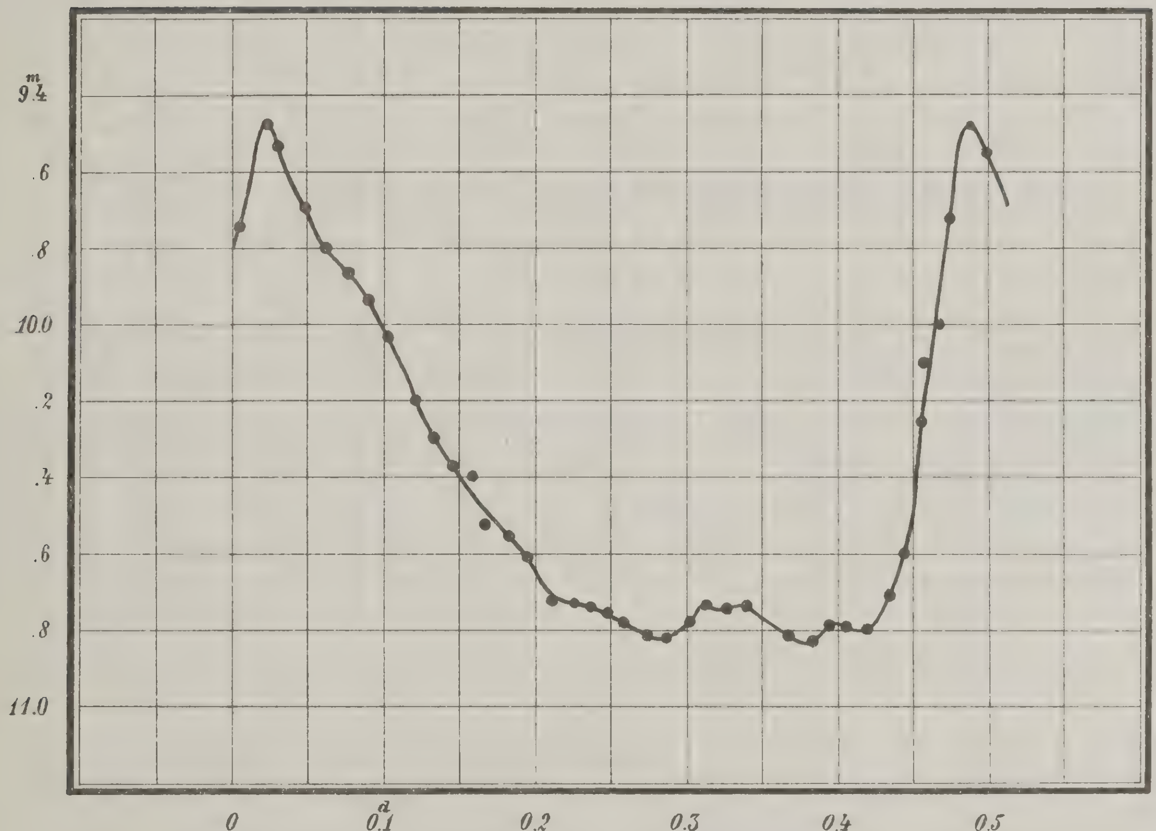
S. BELJAWSKY. Sur l'étoile variable RV Ursae Mj.



Courbe d'éclat

1915. № 68.

ИЗВѢСТІЯ
НИКОЛАЕВСКОЙ ГЛАВНОЙ АСТРОНОМИЧЕСКОЙ ОБСЕРВАТОРІИ.
Томъ VI, 8.

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О вліяніи періодическаго члена на среднюю ошибку.

Б. Нумерова.

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1) Пусть имѣемъ для ряда равноотстоящихъ моментовъ $t = 0, 1, 2 \ldots n-2, n-1$ рядъ значеній нѣкоторой величины Δ. Каждое значеніе величины Δ будемъ разсматривать, какъ сумму случайной величины и періодическаго члена. Напишемъ $\Delta_i = x_i + y_i$, $i = 0, 1, 2 \ldots n-1$. Здѣсь x_i случайная часть, а y_i — періодическая. Величины Δ_i единственно намъ извѣстныя, вопросъ заключается въ выдѣленіи изъ нихъ періодическаго члена y.

Разсмотримъ рядъ $\Delta_0\ \Delta_1\ \Delta_2 \ldots \Delta_{n-1}$ и выведемъ изъ него величину ε_1, подобную средней ошибкѣ,

$$\varepsilon_1^2\,(n-1) = \sum_{i=0}^{i=n-1} \Delta_i^2.$$

На основаніи условія $\Delta_i = x_i + y_i$ имѣемъ:

$$\varepsilon_1^2\,(n-1) = \sum_{i=0}^{i=n-1} x_i^2 + \sum_{i=0}^{i=n-1} y_i^2 + 2\sum_{i=0}^{i=n-1} x_i y_i.$$

Разсуждая теоретически, т. е. предполагая, что число n весьма большое число, мы можемъ положить равнымъ нулю выраженіе $\sum_{i=0}^{i=n-1} x_i y_i = 0$. Назовемъ черезъ ε_0 среднюю ошибку случайнаго ряда $x_0 x_1 x_2 \ldots x_{n-1}$, тогда предыдущее равенство перепишется въ слѣдующемъ видѣ:

$$(\varepsilon_1^2 - \varepsilon_0^2)\,(n-1) = \sum_{i=0}^{i=n-1} y_i^2 \ldots\ldots\ldots\ldots (1)$$

Образуемъ изъ ряда величинъ Δ_i новый рядъ, складывая послѣдовательно по k членовъ въ отдѣльныя группы. Назовемъ общій членъ новаго ряда черезъ δ_s. Имѣемъ:

$$\delta_s = \sum_{i=0}^{i=k-1} \Delta_{ks+i}.$$

Здѣсь s нужно давать значенія $s = 0, 1, 2 \ldots m - 1$, гдѣ $m = \frac{n}{k}$.

Величину δ_s представимъ въ видѣ суммы $\delta_s = z_s + u_s$, считая z_s величиной случайной, а u_s величиной періодической. Не трудно видѣть, что

$$z_s = \sum_{i=0}^{i=n-1} x_{ks+i},$$

а

$$u_s = \sum_{i=0}^{i=k-1} y_{ks+i} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (2)$$

Разсмотримъ рядъ $\delta_0\, \delta_1 \ldots \delta_{m-1}$ и выведемъ изъ него величину ε_k по формулѣ:

$$\varepsilon_k^2 (m-1)\, k = \sum_{s=0}^{s=m-1} \delta_s^2 = \sum_{s=0}^{s=m-1} z_s^2 + \sum_{s=0}^{s=m-1} u_s^2 + 2 \sum_{s=0}^{s=m-1} z_s u_s \ldots \quad \ldots \ldots \ldots \quad (3)$$

Если m велико, то можно положить $\sum_{s=0}^{s=m-1} z_s u_s = 0$. На основаніи теоріи случайныхъ ошибокъ имѣемъ $\varepsilon_0^2 (m-1)\, k = \sum_{s=0}^{s=m-1} z_s^2$. Подставляя это выраженіе въ предыдущее равенство и пользуясь условіемъ $n = mk$, получимъ:

$$(\varepsilon_k^2 - \varepsilon_o^2)\,(n-k) = \sum_{s=0}^{s=m-1} u_s^2 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (4)$$

Уравненіе (1) является частнымъ случаемъ (4) при $k = 1$. Формула (4) намъ указываетъ, что средняя ошибка[1]) ε_k тѣсно связана съ суммой $\sum u_s^2$, а слѣдовательно съ видомъ періодической функціи. Попытаемся найти связь между выраженіемъ $\sum u_s^2$, амплитудой, періодомъ и фазой нѣкотораго періодическаго члена. Пусть періодическій членъ y имѣетъ слѣдующую форму

$$y = a \sin (\alpha t + \beta) \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (5)$$

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1) Лучше величина подобная средней ошибкѣ, ибо терминъ средняя ошибка относится къ ряду случайному, а рядъ Δ вовсе не случайный.

Здѣсь a — амплитуда, $\frac{2\pi}{\alpha} = T$ — періодъ и β фаза. Пользуясь условіемъ, что рядъ $y_0\, y_1 \dots y_{n-1}$ относится къ равностоящимъ моментамъ $t = 0, 1, 2 \dots n-1$ мы легко получимъ слѣдующее выраженіе для u_s:

$$u_s = \sum_{i=0}^{i=k-1} y_{ks+i} = \sum_{i=0}^{i=k-1} a \sin\left[\alpha\,(ks+i)+\beta\right] = a\,\frac{\sin\frac{k\alpha}{2}}{\sin\frac{\alpha}{2}} \sin\left(k\alpha s+\beta+\frac{k-1}{2}\,\alpha\right).$$

Выраженіе для $\sum\limits_{s=0}^{s=m-1} u_s^2$ получится въ слѣдующемъ видѣ:

$$\sum_{s=0}^{s=m-1} u_s^2 = a^2\,\frac{\sin^2\frac{k\alpha}{2}}{\sin^2\frac{\alpha}{2}} \sum_{s=0}^{s=m-1} \sin^2\left(k\alpha s+\beta+\frac{k-1}{2}\,\alpha\right) = a^2\,\frac{\sin^2\frac{k\alpha}{2}}{\sin^2\frac{\alpha}{2}}\left[\frac{m}{2} - \frac{\sin n\alpha}{2\sin k\alpha}\cos\left(2\beta+n\alpha-\alpha\right)\right]$$

Подставляя это выраженіе въ (4), получимъ слѣдующее основное уравненіе:

$$(\varepsilon_k^2 - \varepsilon_0^2)\,(n-k) = a^2\,\frac{\sin^2\frac{k\alpha}{2}}{\sin^2\frac{\alpha}{2}}\left[\frac{m}{2} - \frac{\sin n\alpha}{2\sin k\alpha}\cos\left(2\beta+n\alpha-\alpha\right)\right] \;\dots\dots\; (6)$$

Если въ уравненіи (6) ε_k будемъ считать извѣстной (формула 3) для четырехъ значеній k $(k_1\, k_2\, k_3\, k_4)$, то полученныя 4 уравненія достаточны для того, чтобы опредѣлить 4 неизвѣстныхъ величины ε_0, a, α и β. Однако, пользоваться непосредственно уравненіемъ (6) для опредѣленія нашихъ неизвѣстныхъ мы не будемъ, а, преобразуя его, постараемся достигнуть наиболѣе простой формы. Изъ уравненія (6) имѣемъ

$$\frac{2\,(\varepsilon_k^2 - \varepsilon_0^2)}{a^2} = \frac{n}{n-k}\cdot\varphi\,(\alpha k)\,(1 - f_k).$$

Величины

$$\varphi_k = \varphi\,(\alpha k) = \frac{1}{k}\,\frac{\sin^2\frac{\alpha k}{2}}{\sin^2\frac{\alpha}{2}} \;\dots\dots\dots\dots\; (7)$$

и

$$f_k = \frac{k\sin n\alpha}{n\sin k\alpha}\cos\left(2\beta+n\alpha+\alpha\right) \dots\dots\dots\dots\; (8)$$

Множитель $\frac{n}{n-k}$ мы приравняемъ единицѣ, ибо n попрежнему считаемъ весьма большимъ числомъ. Тогда уравненіе (6) приметъ слѣдующій видъ:

$$2\,(\varepsilon_k^2 - \varepsilon_s^2) = a^2\varphi - a^2\,\frac{\operatorname{tg}\frac{k\alpha}{2}}{\operatorname{tg}\frac{\alpha}{2}}\,f_1 \;\dots\dots\dots\dots\; (9)$$

Величина f_1, слѣдуя (8), опредѣляется изъ условія $f_1 = \frac{\sin n\alpha}{n\sin\alpha}\cos\left(2\beta+n\alpha+\alpha\right)$.
Форма (9) основного уравненія можетъ считаться окончательной формой.

2) Будемъ пользоваться уравненіемъ (9) для опредѣленія вида неизвѣстной періодической функціи $y = a \sin(\alpha t + \beta)$. Извѣстными величинами мы считаемъ значенія ε_k для различныхъ значеній k. Неизвѣстными являются: амплитуда a, величина α, тѣсно связанная съ періодомъ равенствомъ $\frac{2\pi}{\alpha} = T$, фаза β и средняя ошибка ε_0 случайнаго ряда.

Значенія ε_k мы опредѣлимъ по формулѣ (3)

$$\varepsilon_k^2 (n-1) = \sum_{s=0}^{s=m-1} \delta_s^2 \ldots\ldots\ldots\ldots\ldots (3)$$

Правая часть уравненія (9) зависитъ отъ весьма неопредѣленной величины γ равной

$$\gamma = \frac{\operatorname{tg} \frac{k\alpha}{2}}{\operatorname{tg} \frac{\alpha}{2}} f_1 = \frac{\operatorname{tg} \frac{k\alpha}{2}}{\operatorname{tg} \frac{\alpha}{2}} \frac{\sin n\alpha}{n \sin \alpha} \cos(2\beta + n\alpha - \alpha) \ldots\ldots\ldots (10)$$

Нетрудно убѣдиться, что γ при n большомъ величина, мало отличающаяся отъ нуля и только въ исключительныхъ случаяхъ можетъ достичь значительной величины, все-же, однако, не превосходящей k. Исключительные случаи характеризуются слѣдующими значеніями k и α

$$\left.\begin{aligned} \alpha &= l\pi \\ \alpha k &= \pi(2l+1) \end{aligned}\right\} \ldots\ldots\ldots\ldots\ldots (11)$$

гдѣ l число цѣлое. Въ первомъ случаѣ максимальное значеніе γ будетъ $k \cos A$, во второмъ $-\frac{2}{k} \cos A$. Здѣсь для краткости положено $A = 2\beta + n\alpha - \alpha$.

Если значенія α и k не удовлетворяютъ условіямъ (11), то, въ силу существованія въ знаменателѣ уравненія (10) весьма большой величины n, можно величиной γ пренебречь. Чѣмъ ближе значенія α и k къ удовлетворенію равенствъ (11), тѣмъ труднѣе доказать малость величины γ. Строго разсуждая, при неизвѣстномъ заранѣе α нельзя быть увѣреннымъ, что условія (11) не удовлетворены, но, во всякомъ случаѣ, это мало вѣроятно со всѣми другими возможными случаями. Въ первомъ рѣшеніи нашей задачи мы величину γ приравняемъ нулю. Полученное приближенное рѣшеніе α укажетъ намъ, при какомъ k второе изъ условій (11) удовлетворяется. Не будемъ пользоваться группировкой, соотвѣтствующей этому значенію k, ибо нѣтъ никакой возможности вычислить величину γ, зная только приближенно значеніе α.

Послѣднія замѣчанія, относящіяся къ величинѣ γ, даютъ намъ право утверждать, что фаза мало вліяетъ на среднюю ошибку, если равенства (11) не удовлетворены, а слѣдовательно фаза не можетъ быть и опредѣлена.

Приступимъ теперь къ рѣшенію упрощеннаго уравненія:

$$2(\varepsilon_k^2 - \varepsilon_0^2) = a^2\varphi_k \ldots\ldots\ldots\ldots \quad (12)$$

Пусть s число группировокъ $(k_1, k_2 \ldots k_s)$. Изъ системы s уравненій (12) введя обозначенія

$$\varepsilon_m^2 = \frac{\Sigma\varepsilon_k^2}{s},\ \varphi_m = \frac{\Sigma\varphi_k}{s} \ldots\ldots\ldots\ldots \quad (13)$$

мы легко получимъ новую систему s уравненій вида (изъ нихъ только $s-1$ независимыхъ)

$$2(\varepsilon_k^2 - \varepsilon_m^3) = a^2(\varphi_k - \varphi_m) \ldots\ldots\ldots\ldots \quad (12^*)$$

Этимъ пробразованіемъ мы исключили одну изъ неизвѣстныхъ ε_0.

Въ правую часть уравненія (12*) входитъ функція φ опредѣляемая уравненіемъ (7).

Слѣдующая таблица даетъ значенія этой функціи по двумъ аргументамъ α и k.

Таблица I. $\varphi(\alpha k) = \frac{1}{k}\frac{\sin^2\frac{k\alpha}{2}}{\sin^2\frac{\alpha}{2}}$

α^0 \ k	1	2	3	4	5	6	7	8
0	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
4	1.00	2.00	2.99	3.98	4.97	5.96	6.92	7.85
8	1.00	1.99	2.96	3.93	4.80	5.62	6.50	7.18
12	1.00	1.98	2.92	3.84	4.62	5.34	5.95	6.40
16	1.00	1.96	2.86	3.61	4.28	4.75	5.11	5.26
20	1.00	1.94	2.76	3.42	3.88	4.12	4.20	4.00
24	1.00	1.91	2.66	3.17	3.46	3.46	3.28	2.86
28	1.00	1.88	2.53	2.92	2.99	2.79	2.40	1.85
32	1.00	1.85	2.40	2 62	2.56	2.16	1.61	1.02
36	1.00	1.81	2.28	2.37	2.10	1.59	0.98	0.44
40	1.00	1.77	2.13	2.07	1.66	1.06	0.50	0.12
44	1.00	1.73	1.99	1.80	1.25	0.66	0.19	0.01
48	1.00	1.67	1.82	1.49	0.90	0.35	0.04	0.03
52	1.00	1.62	1.66	1.25	0.61	0.14	0.00	0.14
56	1.00	1.56	1.49	0.96	0.37	0.03	0.04	0.27
60	1.00	1.50	1.32	0.74	0.20	0.00	0.14	0.37
68	1.00	1.37	1.02	0.38	0.02	0.09	0.34	0.40
76	1.00	1.23	0.72	0.14	0.01	0.24	0.37	0.22
84	1.00	1.10	0.48	0.03	0.11	0.34	0.27	0.05
92	1.00	0.97	0.29	0.00	0.22	0.31	0.11	0.00
100	1.00	0.83	0.14	0.05	0.30	0.21	0.01	0.09
108	1.00	0.70	0.05	0.13	0.30	0.09	0.02	0.18
116	1.00	0.57	0.00	0.21	0.25	0.01	0.10	0.18
124	1.00	0.44	0.00	0.27	0.15	0.01	0.17	0.08

Рѣшеніе уравненія (12*) мы проведемъ на слѣдующемъ примѣрѣ. Для моментовъ равностоящихъ $t = 0, 1, 2 \ldots 143$ было взято 144 случайныхъ числа, поль-

зуясь кривой вѣроятности. Къ каждому члену полученнаго ряда былъ прибавленъ періодическій членъ по формулѣ $y = 4.7 \sin (57° t + 57°)$. Образованъ рядъ Δ. Группировкой по 2, по 3, по 4 и по 5 были образованы четыре новыхъ ряда δ. Таблица II даетъ всю совокупность полученныхъ чиселъ.

Таблица II.

				δ								δ			
t	x	y	Δ	$k=2$	$k=3$	$k=4$	$k=5$	t	x	y	Δ	$k=2$	$k=3$	$k=4$	$k=5$
0	−6	4	−2	−5	−3	−6	7	44	−23	3	−20	−3		4	
1	−7	4	−3					45	12	5	17		24		−18
2	1	1	2	−1				46	3	2	5	7			
3	0	−3	−3		11			47	5	−3	2				
4	18	−5	13	14		26		48	−15	−5	−20	−42	−33	−17	
5	2	−1	1				−6	49	−20	−2	−22				
6	3	3	6	12	8			50	7	2	9	25			6
7	1	5	6					51	11	5	16		8		
8	−6	2	−4	−19		−15		52	−10	3	−7	−8		−34	
9	−13	−2	−15		−11			53	0	−1	−1				
10	16	−5	11	4			4	54	−6	−5	−11	−26	−27		3
11	−4	−3	−7					55	−12	−3	−15				
12	−4	2	−2	1	0	−13		56	−2	1	−1	3		18	
13	−2	5	3					57	0	4	4		19		
14	−4	3	−1	−14				58	1	4	5	15			
15	−12	−1	−13		−31		−27	59	10	0	10				
16	−7	−4	−11	−18		−14		60	9	−4	5	6	5	−2	14
17	−3	−4	−7					61	5	−4	1				
18	1	0	1	4	21			62	0	−1	−1	−8			
19	−1	4	3					63	−10	3	−7		0		
20	13	4	17	23		4	2	64	11	5	16	7		6	
21	6	0	6		−13			65	−10	1	−9				−3
22	−12	−4	−16	−19				66	14	−3	11	−1	18		
23	1	−4	−3					67	−7	−5	−12				
24	−1	−1	−2	6	3	18		68	21	−2	19	7		1	
25	5	3	8				17	69	−14	2	−12		−18		
26	−8	5	−3	12				70	−5	5	0	−6			−7
27	13	2	15		12			71	−9	3	−6				
28	2	−3	−1	−3		0		72	2	−2	1	5	−1	0	
29	3	−5	−2					73	9	−5	4				
30	8	−3	5	3	15		19	74	−3	−3	−6	−5			
31	−4	2	−2					75	0	1	1		8		3
32	7	5	12	17		7		76	10	4	14	7		2	
33	2	3	5		−5			77	−11	4	−7				
34	0	−1	−1	−10				78	0	0	0	−5	−12		
35	−5	−4	−9				−5	79	−1	−4	−5				
36	7	−4	3	−5	0	4		80	−3	−4	−7	−3		22	27
37	−8	0	−8					81	4	0	4		29		
38	1	4	5	9				82	20	4	24	25			
39	0	4	4		−8			83	−3	4	1				
40	−16	0	−16	−12		−19	−39	84	4	1	5	0	−13	−11	
41	8	−4	4					85	−2	−3	−5				3
42	17	−4	13	−7	−27			86	−8	−5	−13	−11			
43	−19	−1	−20					87	4	−2	2		21		

t	x	y	Δ	δ, $k=2$	δ, $k=3$	δ, $k=4$	δ, $k=5$
88	−2	3	1	+19		9	
89	13	5	18				
90	−2	3	1	−10	−26		−38
91	−9	−2	−11				
92	−11	−5	−16	−36		−37	
93	−17	−3	−20		−21		
94	7	1	8	−1			
95	−13	4	−9				15
96	−9	4	−5	5	20	24	
97	10	0	10				
98	19	−4	15	19			
99	8	−4	4		17		
100	2	0	2	13		39	32
101	7	4	11				
102	15	4	19	26	19		
103	6	1	7				
104	−4	−3	−7	3		−23	
105	15	−5	10		−16		−5
106	−5	−2	−7	−26			
107	−22	3	−19				
108	−6	5	−1	11	11	5	
109	10	2	12				
110	2	−2	0	−6			25
111	−1	−5	−6		15		
112	9	−3	6	21		34	
113	14	1	15				
114	5	+5	10	13	20		
115	0	3	3				−13

t	x	y	Δ	δ, $k=2$	δ, $k=3$	δ, $k=4$	δ, $k=5$
116	8	−1	7	0		−16	
117	−3	−4	−7		−23		
118	−3	−4	−7	−16			
119	−9	0	−9				
120	−18	4	−14	−10	−5	−15	−16
121	0	4	4				
122	4	1	5	−5			
123	−7	−3	−10		−1		
124	4	−5	−1	9		29	
125	11	−1	10				31
126	0	3	3	20	28		
127	12	5	17				
128	6	2	8	1		12	
129	−5	−2	−7		4		
130	−5	−5	−10	11			10
131	24	−3	−21				
132	−6	2	−4	7	−1	−2	
133	6	5	11				
134	−11	3	−8	−9			
135	0	−1	−1		−1		4
136	5	−4	1	0		5	
137	3	−4	−1				
138	2	0	2	5	1		
139	−1	4	+3				
140	−8	4	−4	−18		−43	−43
141	−14	0	−14		−39		
142	−16	−4	−20	−25			
143	−1	−4	−5				

Суммы $\Sigma\delta^2$, значенія $2\varepsilon_k^2$ и $2(\varepsilon_k^2 - \varepsilon_m^2)$, вычисленныя по формулѣ (3) и (13), даны въ слѣдующей таблицѣ:

Таблица III.

k	$\Sigma\delta^2$	$2\varepsilon_k^2$	$2(\varepsilon_k^2 - \varepsilon_m^2)$
1	13780	192.8	4.6
2	14120	199.0	10.8
3	14282	202 6	14.4
4	13104	187.2	− 1.0
5	11094	159.6	−28.6

$2\varepsilon_m^2 = 188.2$

Выбирая произвольное значеніе α, мы, пользуясь таблицей функціи φ и формулой (13), легко получимъ значенія коэффиціентовъ при a^2 въ уравненіи (12*) для разныхъ значеній k. Сложимъ s полученныхъ уравненій (изъ нихъ независимыхъ только $s-1$), предварительно измѣнивъ знаки такъ, чтобы получился наи-

большій коэффиціентъ при a^2. Полученное отъ сложенія уравненіе дастъ намъ искомое значеніе для квадрата амплитуды. Съ полученнымъ результатомъ образуемъ выраженіе вида

$$e_k = 2\,(\varepsilon_k^2 - \varepsilon_m^2) - a^2\,(\varphi_k - \varphi_m).$$

Наконецъ образуемъ Σe^2. Этой суммой будетъ характеризоваться произвольное значеніе α. То значеніе угла α будетъ ближе къ истинѣ, которое даетъ наименьшее значеніе суммы Σe^2. Въ нашемъ примѣрѣ (табл. IV) продѣланы 4 гипотезы $\alpha = 52°$, $\alpha = 56°$, $\alpha = 60°$ и $\alpha = 68°$. Полученныя значенія для Σe^2 245, 145, 116 и 251 съ увѣренностью даютъ возможность утверждать, что истинное значеніе угла α близко къ 60°.

Таблица IV.

k	$\alpha = 52°$			$\alpha = 56°$			$\alpha = 60°$			$\alpha = 68°$		
	φ_k	$\varphi_k - \varphi_m$	e_k	φ_k	$\varphi_k - \varphi_m$	e_k	φ_k	$\varphi_k - \varphi_m$	e_k	φ_k	$\varphi_k - \varphi_m$	e_k
1	1.00	—0.23	11.0	1.00	—0.08	6.8	1.00	0.05	3.1	1.00	0.24	— 1.8
2	1.62	0.39	— 0.3	1.56	0.48	— 2.6	1.50	0.55	— 6.1	1.37	0.61	— 5.4
3	1.66	0.43	2.1	1.49	0.41	3.0	1.32	0.37	3.0	1.02	0.26	7.5
4	1.25	0.02	— 1.6	0.96	—0.12	2.3	0.74	—0.21	5.5	0.38	—0.38	9.1
5	0.61	—0.62	—10.9	0.37	—0.71	— 8.8	0.20	—0.75	— 5.5	0.02	—0.74	— 8.9
	1.23		246.9	1.08		144.7	0.95		116.2	0.76		250.6
		1.69			1.80			1.93			2.23	
		48.2			50.2			59.4			59.4	
		$a^2 = 28.5$			27.9			30.8 ± 5.4			26.6	
								$a = 5.5 \pm 0.5$				
								$\alpha = 60°$				

Обращаясь къ условію (11), мы видимъ, что при $k = 3$ оно почти въ точности удовлетворяется и потому является сомнѣніе, имѣемъ-ли мы право пользоваться упрощенной формой (12) основного уравненія (9) при $k = 3$. Повторяемъ, что найти значеніе γ нельзя; единственно намъ остается не пользоваться группировкой $k = 3$. Отбросивъ третью строчку таблицъ III и IV, продѣлавъ вновь рѣшеніе, мы получимъ результатъ мало отличающійся отъ полученнаго выше. Итакъ рѣшеніе задачи мы получили въ слѣдующемъ видѣ:

$$y = 5.5 \sin 60°\, t.$$

Исходная періодическая функція имѣла видъ $y = 4.7 \sin 57°\, t$.

Было продѣлано еще нѣсколько искусственныхъ примѣровъ; результатъ вездѣ получился вполнѣ удовлетворительный.

3) Изложенный выше способъ, опредѣленія неизвѣстной амплитуды и періода, возможно только примѣнять въ тѣхъ случаяхъ, когда рядъ величинъ Δ относится къ моментамъ равноотстоящимъ.

Выведемъ теперь, пользуясь основнымъ уравненіемъ (9), одно слѣдствіе, которое, хотя и не даетъ намъ точнаго понятія объ амплитудѣ, но однако указываетъ на низшій предѣлъ амплитуды и это независимо — будутъ-ли члены ряда Δ относиться къ моментамъ равноотстоящимъ, или нѣтъ. Мы исходимъ изъ формулы (9), давая для k значеніе $k=1$. Имѣемъ

$$2(\varepsilon_1^2-\varepsilon_0^2)=a^2(1-f_1)$$

откуда

$$a^2=\frac{2(\varepsilon_1^2-\varepsilon_0^2)}{1-f_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Величина $f_1=\frac{\sin n\alpha}{n\sin\alpha}\cos A$ всегда удовлетворяетъ условію $(f_1)\leqslant 1$. Уравненіе (14) даетъ

$$a^2\geqslant(\varepsilon_1^2-\varepsilon_0^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Значеніе $n\sin\alpha=N$ при n большомъ и при α не-маломъ можетъ достичь столь большой величины, что дробь $\frac{1}{N}$ будетъ незначительно отличаться отъ нуля. Выраженіе для f_1 даетъ

$$f_1\leqslant\frac{1}{N}$$

Уравненіе (14) обращается въ слѣдующее неравенство:

$$a^2\geqslant\frac{2(\varepsilon_1^2-\varepsilon_0^2)}{1+{}^1/_N}$$

или при N большомъ

$$a^2\geqslant 2(\varepsilon_1^2-\varepsilon_0^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Примѣнимъ неравенство (16) къ наблюденіямъ δ Cassiopeiae въ Пулковѣ на зенитъ-телескопѣ. Это неравенство мы имѣемъ право примѣнить къ наблюденіямъ δ Cass., ибо установленъ съ несомнѣнностью фактъ паденія ошибки при группировкѣ наблюденій δ Cass. Одинъ фактъ паденія ошибки, а не увеличенія позволяетъ утверждать, что α навѣрное $>30°$ (см. формулу (12) и таблицу I).

Наблюдатели	ε_1	$\varepsilon_{min.}$	a^2	a
Бонсдорфъ	0."180	0.120	0.0360	0."190
Семеновъ	0.188	0.115	0.0442	0.210
Земцовъ	0.192	0.139	0.0351	0.187
				0."196

Въ вышеприведенной таблицѣ даны значенія ε_1, какъ даютъ ее разные наблюдатели[1]), $\varepsilon_{min.}$ — минимальное значеніе ошибки, которое получается при соединеніи наблюденій въ группы. Нетрудно видѣть изъ формулы (4), что величина ε_0 не можетъ быть больше этого минимальнаго значенія, а можетъ быть только меньше или равна $\varepsilon_0 \leqslant \varepsilon_{min}$. Вычислимъ по формулѣ (16) значенія a^2 полагая $\varepsilon_0 = \varepsilon_{min}$. Полученное значеніе $a = 0''.196$ можно разсматривать какъ низшій предѣлъ для значенія амплитуды, ибо вообще говоря $\varepsilon_0 < \varepsilon_{min}$. Итакъ, если-бы паденіе ошибки объяснялось простымъ періодическимъ явленіемъ, то нужно ожидать амплитуды по крайней мѣрѣ $0''.20$ — это даетъ поводъ заключить, что врядъ-ли здѣсь имѣется простая періодичность, ибо явленіе со столь большой амплитудой легко можно было-бы опредѣлить изъ наблюденій.

Radiotelegraphic Determination of the Difference of Longitude Paris—Pulkovo.

By B. Semtzoff.

The astronomical observations and the interchange of radiotelegraphic signals were begun June 19, 1914 and extended to July 15, when the observers changed their places of observation. The second part of the work was begun July 25 and was interrupted July 30 by force of circumstances. The first part of the work depends on 18 nights of star observations and receptions of signals, simultaneously at both places of observation. The second part depends only on 5 nights. On an average 20—22 time stars with 3—4 polar stars were observed every night.

The radiotelegraphic signals were received by two methods: 1) by their registration on the chronograph and 2) by observing their coincidence with the beats of a chronometer.

The first method was prefered to the second, because there appeared a variable difference between the observers when employing the method of coincidence.

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1) Mitt. Pulkovo, 1907, № 13, стр. 13. — Publ., Vol. XVIII, VI, Semenow, стр. 25. — Publ., Vol. XXVII. I, Semzoff стр. 104.

The first part of the work yields the following values of the longitude:

	Paris signals.	Petrograd signals.
λ_1	$1^h51^m57^s.601$	$1^h51^m57^s.583$
	± 6	± 10
number of nights	18	12

Taking the mean of the two values of λ_1 we obtain for the value of the difference of longitude Paris-Pulkovo:

$$\lambda_1 = 1^h51^m57^s.592$$
$$\pm 6.$$

Half the difference of the two values gives the velocity of the Hertzian waves

$$w = 0^s.009.$$

The second part of the work with 5 nights yields the value (signals only from Paris)

$$\lambda_2 = 1^h51^m57^s.493$$
$$\pm 6$$

corrected for the time of propagation of the waves.

$\frac{\lambda_1 - \lambda_2}{2} = \delta = +0^s.050$ depends 1) on the personal equation of the observer in determining the clock error and on the difference of the instruments, 2) on the personal equation in receiving the radiotelegraphic signals.

Before starting the work the observers determined directly these quantities and obtained $+0^s.033$ for the personal and instrumental differences and $+0^s.009$ for the personal difference in receiving the signals. The sum $+0^s.042$ confirms the value of δ satisfactorily.

Thus we have finally

$$1^h51^m57^s.542$$
$$\pm 4.$$

The reduction to the centres of the observatories is $= +0^s.102$.

Consequently the difference of longitude between the Meridian of the Pulkovo Observatory and the Observatory of Paris (Méridienne de Cassini) is represented by the value:

$$1^h51^m57^s.644$$
$$\pm 4.$$

February 1915.

Essai d'une recherche sur le spectre du noyau de la comète Delavan (1913 f).

Par A. Bélopolsky.

J'ai essayé d'obtenir le spectre de la comète à l'aide du spectrographe à fente à trois prismes avec une chambre à court-foyer $\left(\frac{O}{F} = \frac{1}{4,5}\right)$. Ce spectrographe est adapté au 30 pouces.

La première pose le 12 octobre durait seulement 65 min. Sur la plaque on ne trouve aucune trace du spectre. La seconde fois le 13 octobre, la durée de la pose fut $2^h 15^m$. Cette fois-ci on voit sur la plaque un spectre continu très étroit, très faible avec des raies d'absorption qui coïncident à peu près avec les raies du spectre artificiel du fer qui se trouve sur la même plaque. Leur intensité relative correspond assez bien a l'intensité des raies du spectre solaire. Dans la table suivante on trouve la longueur d'onde et la description des raies.

λ		*E*	λ		*E*
452.9	μμ	Fe faible; le spectre continu est faible	437.0	μμ	Fe très faible
449.5	„	Fe faible	436	„	Fe faible
449.0	„	Fe faible	435.2	„	Fe, Mg, Cr. faible
448.1	„	Mg, Fe très nette	434.1	„	$H\gamma$ faible, diffuse
444.3	„	assez nette	432.6	„	Fe assez nette
441.5	„	Fe nette	430.8	„	Fe assez nette
440.5	„	Fe assez nette	427.2	„	Fe faible; le sp. continu est faible
438.4	„	Fe très nette	426	„	Fe?
437.5	„	Fe très faible	422.7	„	Fe très faible

Malgré la petite dispersion de l'instrument (1 mm. $= 32$ A° pour $H\gamma$) et la faiblesse du spectre, j'ai taché de déterminer la vitesse du noyau dans la direction du rayon visuel en mesurant le déplacement des raies les plus distinctes relativement au raies du spectre artificiel du fer. Comme ces mesures sont très difficiles et fatigantes, j'en ai fait trois séries indépendantes; chaque série s'effectuait dans deux directions opposées du spectrogramme. La constante K pour transformer les lectures du tambour de la vis de l'appareil de mesure en kilomètres fut calculée d'après les mesures d'un spectrogramme de l'étoile β des Gémeaux, obtenu avec les mêmes instruments.

Comète 1913 f.

λ	K	1re sér. Δ	v	2me sér. Δ	v	3me sér. Δ	v
441.5 μμ	5.67 km.	+ 0.0^p	+ 0.0 km.	+ 0.5^p	+ 2.8 km.	+ 0.5^p	+ 2.8 km.
440.5 „	5.60 „	+ 0.6	+ 3.4 „	+ 1.3	+ 7.3 „	+ 0.4	+ 2.2 „
438.4 „	5.47 „	+ 0.9	+ 4.9 „	+ 1.3	+ 7.1 „	+ 0.4	+ 2.2 „
432.6 „	5.12 „	+ 0.2	+ 1.0 „	+ 0.5	+ 2.6 „	+ 0.0	0 „
430.8 „	5.02 „	+ 0.4	+ 2.0 „	+ 0.6	+ 3.0 „	— 0.1	— 0.5 „

Les vitesses moyennes de chaque série sont:

1re s. $v = +2.3$ km. ± 0.9 km.
2me s. $v = +4.6$ „ ± 1.1 „
3me s. $v = +1.3$ „ ± 0.7 „

D'où nous recevons $v = +2.7$ km. ± 0.95 km.[1]).

D'après Poincaré (C. R. 1895, № 8, 25 Février), la vitesse r. d'un corps réfléchissant la lumière solaire est proportionelle à

$$\frac{dr}{dt} + \frac{d\Delta}{dt}$$

où r et Δ sont les distances au Soleil et à la Terre.

D'après l'éphéméride de la comète nous trouvons pour le 13.25 Octobre t. m. de Poulkovo

$$\frac{dr}{dt} = -5.1 \text{ km.} \qquad \frac{d\Delta}{dt} = +7.3 \text{ km.}$$

ainsi

$$\frac{dr}{dt} + \frac{d\Delta}{dt} = +2.2 \text{ km.},$$

ce qui s'accorde assez bien avec nos mesures. On peut ainsi faire la conclusion que le spectre que j'ai obtenu appartient à la lumière solaire, réfléchie par le noyau de la comète. Aucune raie brillante n'est visible sur le spectrogramme. L'éclat du noyau était d'après les photographies de M. Kostinsky au dessous de la 6me grandeur et son diamètre à peu près $= 10''$.

1) Si l'on prend compte de l'erreur moyenne de chaque série, $v = 2.06$ km.

Observations d'occultations en 1914.

Par L. Okoulitch.

I. *Occultation de la planète Mars le 11 janvier.* L'observation de ce phénomène a donné un résultat mediocre vu la faible hauteur de la Lune au dessus de l'horizon et les mauvaises images. J'ai observé l'immersion et l'émersion des deux bords de la planète à l'équatorial de 15 p. avec un grossissement de 275 f. Les moments des contacts ont été enregistrés au chronographe Hipp; la pendule Hauth à laquelle le chronographe est relié était comparée avant et après l'observation à la pendule Kessels. La marche horaire de la pendule Hauth a été prise en consideration. La temperature était assez basse (—23° C.) et un vent NE assez fort faisait trembler la lunette. Le bord de la Lune ondulait et l'image de la planète était fortement irisée. Les moments de l'immersion et de l'émersion en temps moyen de Poulkovo sont:

	I bord	II bord
Immersion...	$2^h 59^m 53^s.2$	$3^h\ 0^m 39^s.3$
Émersion....	3 15 38.3	16 18.8

Le calcul, d'après les formules et les données du Nautical Almanac, donne réspectivement pour le centre de Mars:

Immersion...	$3^h\ 1^m$
Émersion....	3 15

II. *Occultation des Pléiades le 4 février.* La Lune a occulté en 1914 13 fois les Pléiades et plusieurs de ces occultations devaient être visibles à Poulkovo. Nous ne pûmes observer, M. Wyssotsky et moi, que l'occultation du 4 février et encore en partie seulement, le ciel couvert a empeché d'observer toutes les autres.

Les instruments et le grossissement employés étaient les mêmes que pour l'occultation de Mars, chaque observateur devait observer l'immersion et l'émersion de la moitié des étoiles occultées.

Malheuresement l'occultation fut observée à travers de rares éclaircies dans d'épais nuages et on n'a pu enregistrer que les moments ci-dessous (t. m. Poulk.)

Etoile	Immersion	Émersion	Obs.
17 Taureau	$4^h 17^m 34^s.1$	$4^h 58^m 21^s.1$	O
19 „	32 31.4	—	W
20 „	44 0.8	—	O

Poulkovo, mars 1915.

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ИЗВѢСТІЯ

НИКОЛАЕВСКОЙ ГЛАВНОЙ АСТРОНОМИЧЕСКОЙ ОБСЕРВАТОРІИ.

Томъ VI, 9.

BULLETIN

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Photometric observations of the variable T V Cassiopeiae.

By I. BALANOWSKY.

The variability of this star was first discovered by Astbury in 1911. He also suggested this star to be of the Algoltype with a comparatively short period ($1^d.8$). Afterwards it was observed by Paul S. Yendell, Rudolf Lehnert and C. Hoffmeister. But their observations have not been published in full and the form of the curve is not yet certainly known. Orazio Lazzarino has made a small series of observations with the wedge photometer and published the light curve for the vicinity of minimum, when it has an unsymmetrical form (A. N. 4727).

Zöllner's photometer, adjusted to the refractor with an objectglass of 125^{mm} was used for my observations of T V Cassiopeiae at Pulkovo. They extended from November 8, 1911 to April 25, 1914. The method employed in my observations has been exposed in the paper on T T Aurigae *). The invariable BD + 58°.24 (7.8) which is but in a few minutes distance from the variable was taken as comparison star.

By and by it proved inconvenient to utilize for the photometer the lamp Nernst which was fed from a battery of accumulators supplying various wants of the observatory. Therefore it was replaced by a 8-volt incandescent

*) Mitteilungen . . . . Pulkowo № 57.

lamp (Osram). Observations with the lamp Nernst went on until August 25, 1913. When a small battery of accumulators of nine elements 1.25 volt each was established exclusively for this purpose.

In all 484 observations were obtained. Great care was taken to distribute the observations as equally as possible over the whole period of the variations of brightness. But still it has not been possible to realize this plan quite satisfactorily. Nevertheless the obtained observations show sufficient evidence of the pecularities of the light-curve of T V Cassiopeiae.

Observations.

All observations of T V Cassiopeiae are registered in Table I. The headings of the columns have the following significations: t = Pulkovo Mean Time of the observations, recorded with an accuracy to a minute in the middle of the observations (8 settings of the circle); J. D. — Julian days; Δt — reduction to the Sun's centre; M — heliocentric minimum, nearest to the moment of observation calculated by the formula given below; τ — phase (t — M).

Δm — the observed difference between the brightness of the comparison star and that of the variable, in the sense of var — a.

Table I.

№	Date	t	J. D.	Δt	M	τ	Δm
1	1911 November 8	$10^h\ 5^m$	$2419349^d.4201$	$+0^d.0036$	$2419349^d.2841$	$0^d.1396$	$-0^m.36$
2	18	11 53	359.4951	+ 35	358.3471	1.1515	−0.51
3	22	11 19	363.4717	+ 34	361.9723	1.5028	−0.34
4	26	6 4	367.2530	+ 32	365.5975	1.6587	−0.46
5	»	9 55	.4135	»	367.4101	0.0066	+0.47
6	»	10 13	.4257	»	»	0.0188	+0.42
7	»	34	.4403	»	»	0.0334	+0.32
8	»	11 37	.4841	»	»	0.0771	+0.09
9	»	50	.4930	»	»	0.0861	−0.08
10	»	12 0	.5000	»	»	0.0932	−0.08
11	»	7	.5049	»	»	0.0980	−0.19
12	»	22	.5153	»	»	0.1084	−0.28
13	»	41	.5257	»	»	0.1188	−0.33
14	28	6 19	369.2628	+ 31	369.2227	0.0432	+0.20

№	Date		t	J. D.	Δt	M	τ	Δm
15	1911 November	28	$6^h 40^m$	$2419369^d.2702$	$+0^d.0031$	$2419369^d.2227$	$0^d.0506$	$+0^m.04$
16		„	8 41	.3618	„	„	0.1422	—0.42
17		„	9 25	.3924	„	„	0.1728	—0.40
18		„	12 56	.5382	„	„	0.3186	—0.44
19		29	5 3	370.2103	+ 30	„	0.9906	—0.32
20		„	6 28	.2698	„	„	1.0501	—0.44
21		„	13 52	.5780	„	„	1.3583	—0.72
22	Dec.	1	5 55	372.2464	„	371.0353	1.2141	—0.45
23	1912 Febr.	4	9 32	437.3958	— 6	436.2890	1.1062	—0.72
24		6	9 33	439.3979	— 7	438.1016	1.2956	—0.51
25		„	11 7	.4632	„	„	1.3616	—0.39
26		„	12 56	.5389	„	„	1.4373	—0.36
27		7	6 53	440.2868	„	439.9142	0.3719	—0.17
28		12	6 48	445.2833	— 11	443.5394	1.7428	+0.02
29		„	10 0	.4167	„	445.3520	0.0636	—0.06
30		„	10 31	.4382	„	„	0.0851	—0.08
31		„	50	.4514	„	„	0.0983	—0.06
32		13	7 29	446.3118	— 12	„	0.9586	—0.44
33		„	9 30	.3958	„	„	1.0426	—0.32
34		19	7 51	452.3271	— 15	450.7898	1.5358	—0.61
35		20	8 46	453.3653	— 16	452.6025	0.7612	—0.39
36		„	10 8	.4222	„	„	0.8181	—0.26
37		„	11 55	.4965	„	„	0.8924	—0.31
38		„	12 13	.5090	„	„	0.9040	—0.40
39		21	7 42	454.3208	„	„	1.7163	—0.09
40		„	8 16	.3444	„	„	1.7393	—0.08
41		„	9 3	.3771	„	„	1.7730	+0.52
42		„	9 43	.4049	„	„	1.8080	+0.25
43		„	55	.4132	„	„	1.8091	+0.32
44		„	10 1	.4174	„	454.4151	0.0007	+0.40
45		„	25	.4340	„	„	0.0173	+0.30
46		„	11 9	.4646	„	„	0.0479	+0.20
47		„	12 29	.5201	„	„	0.1034	+0.04
48		24	7 39	457.3187	— 18	456.2277	1.0892	—0.48
49	March	15	10 39	477.4437	— 27	476.1663	1.2747	—0.46
50		17	8 27	479.3521	— 28	477.9789	1.3704	—0.52
51		„	10 56	.4555	„	„	1.4738	—0.60
52		18	9 9	480.3812	„	479.7915	0.5869	—0.45
53		26	10 14	488.4264	— 31	487.0419	1.3814	—0.52

№	Date		t	J. D.	Δt	M	τ	Δm
54	1912 April	3	$9^h 19^m$	$2419496^d.3882$	$-0^d.0034$	$2419496^d.1049$	$0^d.2799$	$-0^m.42$
55		4	9 13	497.3840	"	"	1.2757	−0.50
56		8	11 49	501.4924	− 35	499.7302	1.7587	+0.22
57		"	12 16	.5111	"	"	1.7774	+0.31
58		"	56	.5389	"	"	1.8052	+0.32
59		"	13 13	.5507	"	501.5428	0.0044	+0.52
60		19	10 14	512.4264	− 36	512.4184	0.0044	+0.47
61		"	31	.4382	"	"	0.0162	+0.36
62		"	13 46	.5736	"	"	0.1516	−0.38
63		21	10 26	514.4347	"	514.2310	0.2001	−0.32
64		22	10 39	515.4437	"	"	1.2091	−0.41
65		30	10 24	523.4333	"	523.2940	0.1357	−0.42
66	May	8	9 57	531.4146	− 35	530.5444	0.8667	−0.56
67		"	11 13	.4674	"	"	0.9195	−0.46
68	October	4	8 11	680.3410	+ 33	679.1778	1.1665	−0.38
69		7	8 9	683.3396	+ 34	682.8030	0.5400	−0.58
70		"	13 50	.5764	"	"	0.7768	−0.54
71		9	7 26	685.3097	+ 35	684.6157	0.6975	−0.50
72		"	10 4	.4194	"	"	0.8072	−0.43
73		10	7 44	686.3222	"	"	1.7100	−0.20
74		"	10 10	.4236	"	686.4283	0.0008	+0.30
75		"	20	.4305	"	"	0.0057	+0.26
76		"	10 30	.4375	"	"	0.0127	+0.48
77		"	45	.4479	"	"	0.0231	+0.28
78		"	11 18	.4708	"	"	0.0460	+0.05
79		23	7 22	699.3069	+ 36	699.1165	0.1940	−0.16
80		24	7 10	700.2986	"	"	1.1857	−0.70
81		"	10 23	.4326	"	"	1.3197	−0.50
82		28	6 46	704.2819	"	702.7417	1.5438	−0.56
83	November	6	6 23	713.2660	+ 35	711.8047	1.4648	−0.48
84		"	11 3	.4604	"	"	1.6592	−0.39
85	1913 January	5	14 13	774.5924	+ 14	773.4332	1.1606	−0.30
86		31	6 31	799.2715	− 3	798.8096	0.4616	−0.60
87		"	10 26	.4347	"	"	0.6248	−0.42
88	February	17	7 27	816.3104	− 14	815.1231	1.1859	−0.55
89		18	6 30	817.2708	"	816.9357	0.3337	−0.45
90		"	7 47	.3243	"	"	0.3874	−0.45
91		"	9 59	.4160	"	"	0.4789	−0.50
92		22	6 55	821.2882	− 17	820.5609	0.7256	−0.32

№	Date		t	J. D.	Δt	M	τ	Δm
93	1913 February	22	10^h54^m	$2419821\overset{d}{.}4542$	$-0\overset{d}{.}0017$	$2419820\overset{d}{.}5609$	$0\overset{d}{.}8916$	$-0\overset{m}{.}20$
94		„	59	.4576	„	„	0.8950	—0.22
95		23	6 57	822.2896	— 18	„	1.7269	—0.10
96		„	7 43	.3215	„	„	1.7588	+0.14
97		24	9 18	823.3875	„	822.3735	1.0122	—0.44
98		„	12 19	.5132	„	„	1.1379	—0.54
99		25	6 33	824.2729	— 19	824.1861	0.0849	—0.20
100		„	7 10	.2986	„	„	0.1106	—0.43
101		„	46	.3236	„	„	0.1356	—0.44
102	March	2	7 54	829.3292	— 21	827.8113	1.5158	—0.49
103		„	9 44	.4056	„	„	1.5922	—0.49
104		„	11 52	.4944	„	„	1.6810	—0.19
105		9	8 11	836.3410	— 25	835.0617	1.2768	—0.44
106		„	10 15	.4271	„	„	1.3629	—0.44
107		„	11 13	.4674	„	„	1.4032	—0.43
108		„	14 27	.6021	„	„	1.5379	—0.54
109		12	10 43	839.4465	— 26	838.6869	0.7570	—0.48
110		„	11 41	.4868	„	„	0.7973	—0.32
111		„	12 50	.5347	„	„	0.8452	—0.48
112		16	10 6	843.4208	— 28	842.3121	1.1059	—0.35
113		19	10 18	846.4292	„	845.9373	0.4891	—0.44
114		„	50	.4514	„	„	0.5113	—0.55
115		„	11 30	.4792	„	„	0.5391	—0.53
116		„	13 17	.5535	„	„	0.6134	—0.56
117		25	11 46	852.4903	— 31	851.3751	1.1121	—0.50
118		26	10 35	853.4410	„	853.1877	0.2502	—0.41
119		„	11 8	.4639	„	„	0.2731	—0.42
120		„	12 24	.5167	„	„	0.3259	—0.43
121		„	12 41	.5285	„	„	0.3377	—0.40
122		„	13 9	.5479	„	„	0.3571	—0.64
123		27	9 40	854.3194	— 32	„	1.1285	—0.55
124		„	8 44	.3639	„	„	1.1730	—0.51
125		„	9 57	.4146	„	„	1.2237	—0.58
126		28	9 11	855.3826	— 33	855.0004	0.3789	—0.35
127		29	7 56	856.3305	— 34	„	1.3267	—0.49
128		„	9 50	.4097	„	„	1.4059	—0.40
129		„	11 22	.4736	„	„	1.4698	—0.41
130		„	13 34	.5653	„	„	1.5615	—0.43
131		30	8 51	857.3687	„	856.8130	0.5523	—0.50

№	Date		t	J. D.	Δt	M	τ	Δm
132	1913 March	31	7^h43^m	$2419858.^d3215$	$-0.^d0034$	$2419856.^d8130$	$1.^d5051$	$-0.^m39$
133		»	10 2	.4180	»	»	1.6016	—0.48
134		»	10 23	.4226	»	»	1.6062	—0.34
135		»	46	.4486	»	»	1.6322	—0.51
136		»	11 23	.4743	»	»	1.6579	—0.15
137		»	48	.4917	»	»	1.6753	—0.25
138		»	12 17	.5118	»	»	1.6954	—0.10
139		»	42	.5292	»	»	1.7128	—0.19
140		»	13 9	.5479	»	»	1.7315	—0.01
141	April	1	7 58	859.3319	— 35	858.6256	0.7028	—0.59
142		2	9 44	860.4056	»	»	1.7765	+0.23
143		»	52	.4111	»	»	1.7820	+0.33
144		»	10 15	.4271	»	»	1.7980	+0.27
145		»	36	.4417	»	860.4382	0.0000	+0.42
146		»	50	.4514	»	»	0.0097	+0.31
147		»	11 19	.4715	»	»	0.0298	+0.27
148		4	8 2	862.3347	»	862.2508	0.0804	+0.02
149		»	34	.3570	»	»	0.1027	—0.19
150		»	53	.3701	»	»	0.1158	—0.21
151		»	10 3	.4187	»	»	0.1644	—0.48
152		»	56	.4555	»	»	0.2012	—0.46
153		»	11 18	.4708	»	»	0.2165	—0.31
154		»	12 1	.5007	»	»	0.2464	—0.45
155		8	9 37	866.4007	»	865.8760	0.5212	—0.51
156		»	10 30	.4375	»	»	0.5580	—0.54
157		9	8 1	867.3340	»	»	1.4545	—0.41
158		13	10 25	871.4340	»	871.3138	0.1167	—0.23
159		»	11 32	.4806	»	»	0.1433	—0.42
160		15	10 44	873.4472	»	873.1264	0.3173	—0.59
161		»	11 11	.4660	»	»	0.3361	—0.42
162		»	11 29	.4785	»	»	0.3486	—0.51
163		22	10 57	880.4562	— 36	880.3768	0.0758	—0.05
164	May	9	10 58	897.4569	— 35	896.6902	0.7632	—0.26
165		»	11 33	.4812	— 35	»	0.7875	—0.41
166	August	23	9 58	2420003.4153	+ 15	2420001.8212	1.5956	—0.47
167		24	9 37	004.4007	»	003.6338	0.7684	—0.46
168		25	9 30	005.3958	+ 17	»	1.7637	+0.14
169		»	34	.3986	»	»	1.7665	+0.22
170		»	37	.4007	»	»	1.7686	+0.35

№	Date		t	J. D.	Δt	M	τ	Δm
171	1913 August	25	9^h42^m	$2420005^d.4042$	$+0^d.0017$	$2420003^d.6338$	$1^d.7721$	$+0^m.37$
172		"	46	.4069	"	"	1.7748	+0.43
173		"	50	.4097	"	"	1.7776	+0.46
174		"	55	.4132	"	"	1.7811	+0.30
175		"	10 5	.4201	"	"	1.7880	+0.44
176		"	9	.4229	"	"	1.7908	+0.53
177		"	14	.4264	"	"	1.7943	+0.53
178		"	19	.4299	"	"	1.7978	+0.45
179		"	23	.4326	"	"	1.8005	+0.54
180		"	28	.4361	"	"	1.8040	+0.64
181		"	37	.4424	"	"	1.8103	+0.46
182		"	43	.4465	"	005.4464	0.0018	+0.53
183		"	47	.4493	"	"	0.0046	+0.62
184		"	52	.4528	"	"	0.0081	+0.60
185		"	56	.4555	"	"	0.0108	+0.58
186		"	11 0	.4583	"	"	0.0136	+0.58
187		"	5	.4618	"	"	0.0171	+0.62
188		"	15	.4687	"	"	0.0240	+0.44
189		"	19	.4715	"	"	0.0268	+0.43
190		"	23	.4743	"	"	0.0296	+0.30
191		"	27	.4771	"	"	0.0324	+0.35
192		"	52	.4944	"	"	0.0497	+0.28
193	September	12	10 33	023.4396	+ 25	021.7598	1.6823	—0.48
194		"	38	.4430	"	"	1.6857	—0.32
195		"	44	.4472	"	"	1.6899	—0.24
196		13	9 43	024.4049	"	023.5724	0.8350	—0.44
197		"	10 36	.4417	"	"	0.8718	—0.40
198		"	11 36	.4833	"	"	0.9134	—0.53
199		14	8 0	025.3333	+ 26	"	1.7635	+0.31
200		"	5	.3368	"	"	1.7670	+0.38
201		"	12	.3417	"	"	1.7719	+0.36
202		16	11 10	027.4653	+ 27	027.1971	0.2704	—0.67
203		17	9 17	028.3868	"	"	1.1919	—0.46
204		28	8 45	039.3646	+ 28	038.0732	1.2942	—0.55
205		"	9 53	.4104	"	"	1.3400	—0.43
206	October	16	6 0	057.2500	+ 35	056.1993	1.0542	—0.30
207		"	7 2	.2930	"	"	1.0972	—0.41
208		19	6 5	060.2535	"	059.8245	1.4325	—0.41
209		22	6 40	063.2778	+ 36	061.6371	1.6443	—0.30
210		"	10 7	.4215	"	"	1.7880	+0.40
211		"	10 19	.4299	"	"	1.7964	+0.56

№	Date	t	J. D.	Δt	M	τ	Δm
212	1913 November 25	$10^h\ 2^m$	$2420097.^d4180$	$+0.^d0032$	$2420096.^d0766$	$1.^d3446$	$-0.^m61$
213	»	11 11	.4660	»	»	1.3926	−0.56
214	29	11 23	101.4743	+ 31	099.7018	1.7756	+0.38
215	»	27	.4771	»	»	1.7784	+0.32
216	»	33	.4812	»	»	1.7825	+0.35
217	»	39	.4854	»	»	1.7867	+0.31
218	»	44	.4889	»	»	1.7902	+0.44
219	»	51	.4937	»	»	1.7950	+0.42
220	»	57	.4979	»	»	1.7992	+0.48
221	»	12 3	.5021	»	»	1.8034	+0.49
222	»	10	.5069	»	»	1.8082	+0.56
223	»	15	.5104	»	»	1.8117	+0.45
224	»	29	.5201	»	101.5144	0.0088	+0.38
225	»	34	.5236	»	»	0.0123	+0.39
226	»	47	.5326	»	»	0.0213	+0.35
227	»	52	.5361	»	»	0.0248	+0.36
228	»	56	.5389	»	»	0.0276	+0.29
229	»	13 1	.5423	»	»	0.0310	+0.20
230	»	6	.5458	»	»	0.0345	+0.32
231	»	11	.5493	»	»	0.0380	+0.27
232	»	16	.5528	»	»	0.0415	+0.14
233	»	24	.5583	»	»	0.0470	+0.07
234	»	29	.5618	»	»	0.0505	+0.11
235	»	33	.5646	»	»	0.0533	+0.05
236	»	37	.5674	»	»	0.0561	+0.08
237	December 5	7 55	107.3285	+ 29	106.9523	0.3791	−0.52
238	6	9 29	108.3951	»	»	0.4457	−0.50
239	»	53	.4118	»	»	0.4624	−0.41
240	»	11 22	.4736	»	»	0.5242	−0.46
241	20	6 57	122.2896	+ 22	121.4531	0.8387	−0.43
242	21	12 58	123.5403	»	123.2657	0.2768	−0.34
243	»	13 56	.5805	»	»	0.3170	−0.46
244	»	14 19	.5965	»	»	0.3330	−0.48
245	25	10 51	127.4521	+ 19	126.8909	0.5631	−0.57
246	»	12 28	.5194	»	»	0.6304	−0.49
247	26	9 45	128.4062	»	»	1.5172	−0.27
248	»	10 13	.4257	»	»	1.5367	−0.40
249	28	6 5	130.2535	+ 18	128.7035	1.5518	−0.48
250	»	7 38	.3180	»	»	1.6163	−0.48
251	»	54	.3292	»	»	1.6275	−0.53
252	»	9 16	.3861	»	»	1.6844	−0.32

№	Date	t	J. D.	Δt	M	τ	Δm
253	1913 December 28	9^h21^m	$2420130^d.3896$	$+0^d.0018$	$2420128^d.7035$	$1^d.6879$	$-0^m.25$
254	„	27	.3937	„	„	1.6920	−0.27
255	„	33	.3979	„	„	1.6962	−0.26
256	„	38	.4014	„	„	1.6997	−0.20
257	„	48	.4083	„	„	1.7066	−0.27
258	„	59	.4160	„	„	1.7143	−0.17
259	„	10 3	.4187	„	„	1.7170	−0.14
260	1914 January 27	6 43	160.2799	0	159.5178	0.7621	−0.41
261	„	7 0	.2917	„	„	0.7739	−0.34
262	„	12	.3000	„	„	0.7822	−0.47
263	30	10 41	163.4451	— 3	163.1430	0.3018	−0.35
264	„	11 1	.4590	„	„	0.3157	−0.32
265	„	36	.4833	„	„	0.3400	−0.38
266	„	57	.4979	„	„	0.3546	−0.33
267	„	12 35	.5243	„	„	0.3810	−0.51
268	February 1	9 5	165.3785	„	164.9556	0.4226	−0.44
269	„	12 29	.5201	„	„	0.4642	−0.40
270	12	10 32	176.4389	— 11	175.8312	0.6066	−0.59
271	„	50	.4514	„	„	0.6191	−0.39
272	„	11 7	.4632	„	„	0.6309	−0.56
273	16	9 32	180.3972	— 14	179.4564	0.9394	−0.52
274	„	45	.4062	„	„	0.9484	−0.39
275	„	53	.4118	„	„	0.9540	−0.36
276	„	10 10	.4236	„	„	0.9658	−0.49
277	„	24	.4333	„	„	0.9755	−0.36
278	„	38	.4430	„	„	0.9852	−0.41
279	„	56	.4555	„	„	0.9977	−0.42
280	„	11 7	.4632	„	„	1.0054	−0.44
281	„	21	.4729	„	„	1.0151	−0.52
282	19	7 38	183.3180	— 15	183.0816	0.2349	−0.32
283	23	6 34	187.2736	— 18	186.7068	0.5650	−0.42
284	„	50	.2847	„	„	0.5761	−0.44
285	„	7 0	.2917	„	„	0.5831	−0.43
286	„	12	.3000	„	„	0.5914	−0.43
287	„	33	.3146	„	„	0.6060	−0.39
288	„	45	.3229	„	„	0.6143	−0.58
289	„	57	.3312	„	„	0.6226	−0.50
290	„	9 38	.4014	„	„	0.6928	−0.35
291	„	49	.4090	„	„	0.7004	−0.31
292	„	10 0	.4167	„	„	0.7081	−0.37

№	Date		t	J. D.	Δt	M	τ	Δm
293	1914 February	23	10^h14^m	$2420187^d.4264$	$-0^d.0018$	$2420186^d.7068$	$0^d.7178$	$-0^m.46$
294		»	30	.4375	»	»	0.7289	—0.49
295		»	12 12	.5083	»	»	0.7987	— 0.60
296		24	7 50	188.3264	»	»	1.6178	—0.52
297		»	8 0	.3333	»	»	1.6247	—0.42
298		»	16	.3444	»	»	1.6358	—0.57
299		»	9 55	.4132	»	»	1.7046	—0.38
300		»	59	.4160	»	»	1.7074	—0.21
301		»	10 4	.4194	»	»	1.7108	—0.02
302		»	8	.4222	»	»	1.7136	—0.03
303		»	12	.4250	»	»	1.7164	—0.13
304		»	16	.4278	»	»	1.7192	—0.14
305		»	21	.4312	»	»	1.7226	+0.02
306		»	27	.4354	»	»	1.7268	—0.07
307		»	33	.4396	»	»	1.7310	—0.18
308		»	39	.4437	»	»	1.7351	+0.14
309		»	44	.4472	»	»	1.7386	+0.13
310		»	49	.4507	»	»	1.7421	+0.08
311		»	56	.4555	»	»	1.7469	+0.02
312		»	11 0	.4583	»	»	1.7497	+0.13
313		»	6	.4625	»	»	1.7539	+0.15
314		»	10	.4653	»	»	1.7567	+0.19
315		»	16	.4694	»	»	1.7608	+0.28
316		»	22	.4736	»	»	1.7650	+0.26
317		»	28	.4778	»	»	1.7692	+0.24
318		»	34	.4819	»	»	1.7733	+0.42
319		»	41	.4868	»	»	1.7782	+0.27
320		»	45	.4903	»	»	1.7817	+0.27
321		»	49	.4923	»	»	1.7837	+0.25
322		»	12 22	.5153	»	»	1.8067	+0.39
323		»	26	.5181	»	»	1.8095	+0.43
324		»	30	.5208	»	»	1.8122	+0.33
325		»	35	.5243	»	188.5194	0.0031	+0.44
326		»	41	.5285	»	»	0.0073	+0.48
327		»	46	.5319	»	»	0.0107	+0.35
328		»	52	.5361	»	»	0.0149	+0.35
329		»	57	.5396	»	»	0.0184	+0.36
330		»	13 3	.5437	»	»	0.0225	+0.41
331		»	9	.5479	»	»	0.0267	+0.25
332		25	7 5	189.2951	— 19	»	0.7738	—0.55
333		»	16	.3028	»	»	0.7815	—0.45

№	Date		t	J. D.	Δt	M	τ	Δm
334	1914 March	10	$7^h\ 5^m$	$2420202^d.2951$	$-0^d.0025$	$2420201^d.2076$	$1^d.0650$	$-0^m.42$
335		»	9	.2979	»	»	1.0878	−0.38
336		»	14	.3014	»	»	1.0913	−0.34
337		»	20	.3055	»	»	1.0954	−0.47
338		»	25	.3090	»	»	1.0989	−0.65
339		»	40	.3194	»	»	1.1093	−0.59
340		»	44	.3222	»	»	1.1121	−0.48
341		»	48	.3250	»	»	1.1149	−0.57
342		»	54	.3292	»	»	1.1191	−0.42
343		»	58	.3319	»	»	1.1218	−0.52
344		»	8 3	.3354	»	»	1.1253	−0.40
345		»	7	.3382	»	»	1.1281	−0.47
346		»	9 51	.4104	»	»	1.2003	−0.42
347		»	10 3	.4187	»	»	1.2086	−0.44
348		»	52	.4528	»	»	1.2427	−0.48
349		»	11 9	.4646	»	»	1.2545	−0.42
350		13	7 30	205.3125	— 27	204.8328	0.4770	−0.54
351		»	42	.3208	»	»	0.4853	−0.46
352		14	9 14	206.3847	»	»	1.5492	−0.33
353		»	27	.3938	»	»	1.5583	−0.40
354		20	7 5	212.2951	— 29	212.0832	0.2090	−0.44
355		»	38	.3180	»	»	0.2319	−0.40
356		»	46	.3236	»	»	0.2375	−0.21
357		»	56	.3305	»	»	0.2444	−0.54
358		»	9 44	.4056	»	»	0.3194	−0.49
359		23	8 10	215.3403	— 30	213.8958	1.4415	−0.49
360		»	28	.3528	»	»	1.4540	−0.33
361		»	9 35	.3993	»	»	1.5005	−0.44
362		24	8 3	216.3354	»	215.7084	0.6240	−0.56
363		»	21	.3479	»	»	0.6365	−0.45
364		»	33	.3562	»	»	0.6448	−0.46
365		»	45	.3646	»	»	0.6532	−0.42
366		25	10 17	217.4285	— 31	»	1.7170	−0.07
367		»	21	.4312	»	»	1.7197	−0.17
368		»	27	.4354	»	»	1.7239	−0.13
369		»	32	.4389	»	»	1.7274	−0.06
370		»	36	.4417	»	»	1.7302	+0.02
371		»	42	.4458	»	»	1.7343	−0.03
372		»	46	.4486	»	»	1.7371	+0.02
373		»	11 6	.4625	»	»	1.7510	+0.04
374		»	10	.4653	»	»	1.7538	+0.26
375		»	16	.4694	»	»	1.7579	+0.14

№	Date		t	J. D.	Δt	M	τ	Δm
376	1914 March	25	11^h23^m	$2420217.^d4743$	$-0.^d0031$	$2420215.^d7084$	$1.^d7628$	$+0.^m24$
377		»	28	.4778	»	»	1.7663	+0.18
378		»	33	.4812	»	»	1.7697	+0.11
379		»	38	.4847	»	»	1.7732	+0.20
380		»	53	.4951	»	»	1.7836	+0.20
381		»	57	.4979	»	»	1.7864	+0.32
382		»	12 1	.5006	»	»	1.7891	+0.35
383		»	6	.5042	»	»	1.7927	+0.29
384		»	11	.5076	»	»	1.7961	+0.27
385		»	15	.5104	»	»	1.7989	+0.22
386		»	19	.5132	»	»	1.8017	+0.45
387		»	26	.5180	»	»	1.8065	+0.48
388		»	30	.5208	»	»	1.8093	+0.41
389		»	34	.5236	»	»	1.8121	+0.39
390		»	43	.5299	»	217.5210	0.0058	+0.46
391		»	47	.5326	»	»	0.0085	+0.32
392		»	53	.5368	»	»	0.0127	+0.37
393		»	57	.5396	»	»	0.0155	+0.30
394		»	13 3	.5437	»	»	0.0196	+0.45
395		»	7	.5466	»	»	0.0225	+0.32
396		»	14	.5514	»	»	0.0273	+0.32
397		»	18	.5542	»	»	0.0301	+0.21
398		30	8 53	222.3701	— 33	221.1463	1.2205	−0.40
399		»	9 11	.3826	»	»	1.2330	−0.36
400	April	3	9 37	226.4007	— 34	224.7715	1.6258	−0.36
401		»	53	.4118	»	»	1.6369	−0.34
402		4	9 30	227.3958	»	226.5841	0.8083	−0.44
403		»	44	.4056	»	»	0.8181	−0.50
404		»	10 2	.4180	»	»	0.8305	−0.41
405		»	20	.4305	»	»	0.8430	−0.35
406		»	38	.4430	»	»	0.8555	−0.42
407		»	53	.4535	»	»	0.8660	−0.39
408		5	8 5	228.3368	»	»	1.7493	+0.15
409		»	10	.3403	»	»	1.7528	+0.11
410		»	14	.3430	»	»	1.7555	+0.04
411		»	18	.3458	»	»	1.7583	+0.16
412		»	9 2	.3764	»	»	1.7889	+0.31
413		»	6	.3792	»	»	1.7917	+0.30
414		»	11	.3826	»	»	1.7951	+0.49
415		»	15	.3854	»	»	1.7979	+0.36
416		»	19	.3882	»	»	1.8007	+0.37

№	Date		t	J. D.	Δt	M	τ	Δm
417	1914 April	5	9^h23^m	$2420228^d.3910$	$-0^d.0034$	$2420226^d.5841$	$1^d.8035$	$+0^m.36$
418		„	28	.3944	„	„	1.8069	+0.34
419		„	32	.3972	„	„	1.8097	+0.36
420		„	36	.4000	„	„	1.8125	+0.37
421		„	57	.4146	„	228.3967	0.0145	+0.45
422		„	10 2	.4180	„	„	0.0179	+0.40
423		„	6	.4208	„	„	0.0207	+0.31
424		„	10	.4236	„	„	0.0235	+0.29
425		„	15	.4271	„	„	0.0270	+0.26
426		„	22	.4319	„	„	0.0318	+0.10
427		„	26	.4347	„	„	0.0346	+0.19
428		„	30	.4375	„	„	0.0374	+0.28
429		„	35	.4410	„	„	0.0409	+0.16
430		„	40	.4445	„	„	0.0442	+0.16
431		„	11 1	.4590	„	„	0.0589	+0.13
432		„	5	.4618	„	„	0.0617	+0.14
433		„	9	.4646	„	„	0.0645	+0.16
434		„	13	.4673	„	„	0.0672	+0.05
435		„	17	.4701	„	„	0.0700	+0.02
436		„	21	.4729	„	„	0.0728	0.00
437		„	25	.4757	„	„	0.0756	−0.01
438		„	31	.4798	„	„	0.0797	−0.10
439		„	35	.4826	„	„	0.0825	−0.09
440		„	40	.4861	„	„	0.0860	−0.14
441		„	44	.4889	„	„	0.0888	−0.06
442		„	49	.4924	„	„	0.0923	−0.09
443		„	12 12	.5083	„	„	0.1082	−0.33
444		„	16	.5111	„	„	0.1110	−0.31
445		„	20	.5139	„	„	0.1138	−0.22
446		„	24	.5167	„	„	0.1166	−0.25
447		„	28	.5194	„	„	0.1193	−0.24
448		„	33	.5229	„	„	0.1228	−0.29
449		„	37	.5257	„	„	0.1256	−0.34
450		„	42	.5292	„	„	0.1291	−0.31
451		7	9 16	230.3861	— 35	230.2093	0.1733	−0.50
452		„	20	.3889	„	„	0.1761	−0.31
453		„	25	.3924	„	„	0.1796	−0.45
454		„	30	.3958	„	„	0.1830	−0.41
455		„	34	.3986	„	„	0.1858	−0.35
456		„	38	.4014	„	„	0.1886	−0.40
457		„	43	.4049	„	„	0.1921	−0.41
458		„	47	.4076	„	„	0.1948	−0.39

№	Date	t	J. D.	Δt	M	τ	Δm
459	1914 April 7	9^h54^m	$2420230^d.4125$	$-0^d.0035$	$2420230^d.2093$	$0^d.1997$	$-0^m.39$
460	„	58	.4153	„	„	0.2025	−0.47
461	„	10 2	.4180	„	„	0.2052	−0.44
462	„	7	.4215	„	„	0.2087	−0.36
463	25	10 7	248.4215	— 36	248.3353	0.0826	−0.18
464	„	11	.4243	„	„	0.0854	−0.12
465	„	16	.4278	„	„	0.0889	−0.10
466	„	25	.4340	„	„	0.0951	−0.14
467	„	30	.4375	„	„	0.0986	−0.22
468	„	34	.4403	„	„	0.1014	−0.21
469	„	38	.4430	„	„	0.1041	−0.11
470	„	42	.4458	„	„	0.1069	−0.12
471	„	47	.4493	„	„	0.1104	−0.19
472	„	51	.4521	„	„	0.1132	−0.36
473	„	55	.4548	„	„	0.1159	−0.17
474	„	59	.4576	„	„	0.1187	−0.23
475	„	11 4	.4611	„	„	0.1222	−0.31
476	„	8	.4639	„	„	0.1270	−0.27
477	„	31	.4798	„	„	0.1409	−0.38
478	„	35	.4826	„	„	0.1437	−0.50
479	„	40	.4861	„	„	0.1472	−0.36
480	„	45	.4896	„	„	0.1507	−0.35
481	„	49	.4924	„	„	0.1535	−0.40
482	„	53	.4951	„	„	0.1562	−0.37
483	„	56	.4972	„	„	0.1583	−0.52
484	„	12 0	.5000	„	„	0.1611	−0.35

The following remarks have been made while observing:

№ 3 Cloud in North. № 4. Near a cloud. № 22 Current diminishes. № 23 Very bad images, stars very indistinct and oscillating. Temperature — 23°R. № 27 Clouds drawing near. № 32, 33 Cloud in South-East; bad transparency. № 41 Error in reading. № 60 Cirri in West. № 79 Reading doubtful. № 92—94 Very indistinct images. № 132 — 140 Feathery clouds cover the whole sky at day-time. № 148 — 150 Bad images. № 163 Fog. № 206 Cirri. № 247 Very damp. The ocular covered with dew. № 338 — 339 Readings doubtful. № 426 Reading not accurate. № 463 — 484 Cirri in West.

Determination of the period. Precision of the observations and systematic errors.

The observations near minima were traced on millimeter paper and by means of the approximated light-curve the following moments of minima were determined (Greenwich Mean Time).

Date			Minimum	Δt	o — c
1911	November	26	$7^h 39^m$	$+5^m$	-6^m
1912	Febr.	21	8 5	-2	$+6$
	October	10	8 4	$+5$	-7
1913	April	2	8 35	-5	0
	August	25	8 38	$+2$	-2
	November	29	10 7	$+5$	-8
1914	Febr.	24	10 30	-2	$+1$
	March	25	10 32	-4	-1
	April	5	7 43	-5	$+8$

As before Δt is the reduction to the Sun's centre. The determination of these moments offered considerable difficulties due to the insufficient symmetry of the observations and to the unequal depths of different minima. Probably the reason for this phenomenon must be looked for in the „systematic errors of the night". Because the investigation of the difference between the depths of minima, in connection with the form of the curve outside the minima, clearly points to the impossibility to distinguish even from odd minima. But still one can not positively deny the true change of the depths of the minima within the limits $0^m.1 - 0^m.2$.

The obtained moments of minima were compared with those computed by the approximated formula and then the following formula was found which best satisfies our observations.

$$M = 1913 \text{ August } 25.\ 8^h 41^m.5 \text{ G. M. T.} + 1^d 19^h 30^m 8^s.85\ E$$
$$M = 2420005.3622 \quad " \quad " \quad " \quad + 1^d.812603\ E$$

The up to date published observations of minima made by other obsevers are represented by this formula thus:

Date			Heliocentric minimum	o — c	Observer
1911	Oct.	8	9^h10^m G. M. T.	— 5^m	Astbury
1912	Febr.	8	15 32	+ 6	P. Yendell
		28	14 15	+ 18	"
	March	10	11 27	+ 29	"
		10	10 56	— 2	R. Lehnert
	June	25	9 32	— 5	"
	July	13	12 38	0	"
1913	Sept.	3	9 56	— 16	C. Hoffmeister
		10	16 36	+ 20	"
		12	11 28	— 14	"
		23	8 41	— 3	"
	Oct.	2	10 5	— 14	"
		13	7 29	+ 14	"
		31	10 20	+ 4	"
	Nov.	2	5 36	— 11	"

In how far the determinations of minima are inaccurate, may be seen from the comparison of minima March 10, 1912 observed by P. Yendell and R. Lehnert. They diverge by 31^m. This inaccuracy may be explained by a comparatively small amplitude in connexion with a slow variation of the brightness.

Therefore it is scarcely possible to infer from the material available up to the present time, that the period of variation of brightness fluctuates, as was suspected by Orazio Lazzarino (A. N. 4727).

The observations made with the lamp Nernst and those with Osram show considerable divergence which changes with the brightness of the variable. From these differences, smoothes graphically, the following table was obtainen:

Δm	$\Delta m_o — \Delta m_N$
— $0^m.6$	$0^m.00$
— 0.4	— 0.01
— 0.2	— 0.02
0.0	— 0.03
+ 0.2	— 0.04
+ 0.4	— 0.04
+ 0.6	— 0.05

In accordance with this table observations №№ 1—192 were corrected. If the observations are arranged according to increasing τ, table II is obtained. Its headings need no further explanation.

Table II.

№	Obs.	τ	Δm	№	Obs.	τ	Δm	№	Obs.	τ	Δm
1	145	$0^{d}.000$	$+0^{m}.38$	35	331	$0^{p}.022$	$+0^{m}.41$	69	432	$0^{d}.059$	$+0^{m}.13$
2	44	01	+0.36	36	396	22	+0.32	70	433	62	+0.14
3	74	01	+0.26	37	77	23	+0.24	71	29	64	−0.08
4	182	02	+0.48	38	188	24	+0.40	72	434	64	+0.16
5	326	03	+0.44	39	425	24	+0.29	73	435	67	+0.05
6	59	04	+0.47	40	227	25	+0.36	74	436	70	+0.02
7	60	04	+0.42	41	189	27	+0.39	75	437	73	0.00
8	183	05	+0.57	42	332	27	+0.35	76	163	76	−0.07
9	75	06	+0.22	43	397	27	+0.32	77	438	76	−0.01
10	391	06	+0.46	44	426	27	+0.26	78	8	77	+0.06
11	5	07	+0.42	45	228	28	+0.29	79	148	80	+0.05
12	327	07	+0.48	46	190	30	+0.26	80	439	80	−0.10
13	184	08	+0.55	47	398	30	+0.21	81	440	82	−0.09
14	392	08	+0.32	48	147	30	+0.23	82	464	83	−0.18
15	224	09	+0.38	49	229	31	+0.20	83	30	85	−0.10
16	146	10	+0.27	50	191	32	+0.31	84	99	85	−0.22
17	185	11	+0.53	51	427	32	+0.10	85	465	85	−0.12
18	328	11	+0.35	52	7	33	+0.28	86	9	86	−0.10
19	225	12	+0.39	53	230	34	+0.32	87	441	86	−0.14
20	76	13	+0.43	54	428	35	+0.19	88	442	89	−0.06
21	393	13	+0.37	55	429	37	+0.28	89	466	89	−0.10
22	186	14	+0.53	56	231	38	+0.27	90	443	92	−0.09
23	422	14	+0.45	57	430	41	+0.16	91	10	93	−0.10
24	329	15	+0.35	58	232	42	+0.14	92	467	95	−0.14
25	61	16	+0.32	59	14	43	+0.16	93	11	98	−0.21
26	394	16	+0.30	60	431	44	+0.16	94	31	98	−0.08
27	45	17	+0.26	61	78	46	+0.02	95	468	0.099	−0.22
28	187	17	+0.57	62	233	47	+0.07	96	469	0.101	−0.21
29	330	18	+0.36	63	46	48	+0.16	97	47	03	+0.01
30	423	18	+0.40	64	192	50	+0.24	98	149	03	−0.21
31	6	19	+0.38	65	234	50	+0.11	99	470	04	−0.11
32	395	20	+0.45	66	15	51	+0.01	100	471	07	−0.12
33	226	21	+0.35	67	235	53	+0.05	101	12	08	−0.30
34	424	21	+0.31	68	236	56	+0.08	102	444	08	−0.33

№	Obs.	τ	Δm	№	Obs.	τ	Δm	№	Obs.	τ	Δm
103	472	$0^d.010$	$-0^m.19$	145	63	$0^d.200$	$-0^m.34$	187	239	$0^d.462$	$-0^m.41$
104	100	11	−0.44	146	460	00	−0.39	188	270	64	−0.40
105	445	11	−0.31	147	152	01	−0.47	189	351	77	−0.54
106	473	13	−0.36	148	461	02	−0.47	190	91	79	−0.51
107	446	14	−0.22	149	462	05	−0.44	191	352	85	−0.46
108	150	16	−0.23	150	355	09	−0.44	192	113	0.489	−0.55
109	474	16	−0.17	151	463	09	−0.36	193	114	0.511	−0.53
110	158	17	−0.25	152	153	16	−0.32	194	155	21	−0.51
111	447	17	−0.25	153	356	32	−0.40	195	240	24	−0.46
112	13	19	−0.35	154	283	35	−0.32	196	115	39	−0.56
113	448	19	−0.24	155	357	38	−0.21	197	69	40	−0.58
114	475	19	−0.23	156	358	44	−0.54	198	131	52	−0.51
115	476	22	−0.31	157	154	46	−0.46	199	156	58	−0.54
116	449	23	−0.29	158	118	50	−0.42	200	246	63	−0.57
117	450	26	−0.34	159	202	70	−0.67	201	284	65	−0.42
118	477	27	−0.27	160	119	73	−0.43	202	285	76	−0.44
119	451	29	−0.31	161	242	77	−0.34	203	286	83	−0.43
120	65	36	−0.43	162	51	0.280	−0.43	204	52	87	−0.46
121	101	36	−0.45	163	264	0.302	−0.35	205	287	0.591	−0.43
122	1	40	−0.37	164	265	16	−0.32	206	288	0.606	−0.39
123	478	41	−0.38	165	160	17	−0.59	207	271	07	−0.59
124	16	42	−0.43	166	244	17	−0.46	208	116	13	−0.45
125	159	43	−0.43	167	18	19	−0.45	209	289	14	−0.58
126	479	44	−0.50	168	359	19	−0.49	210	272	19	−0.39
127	480	47	−0.36	169	120	26	−0.44	211	290	23	−0.50
128	481	51	−0.35	170	245	33	−0.48	212	363	24	−0.56
129	62	52	−0.39	171	89	34	−0.46	213	87	25	−0.43
130	482	54	−0.40	172	161	36	−0.43	214	247	30	−0.49
131	483	56	−0.37	173	121	38	−0.41	215	273	31	−0.56
132	484	58	−0.52	174	266	40	−0.38	216	364	36	−0.45
133	485	61	−0.35	175	162	49	−0.51	217	365	45	−0.46
134	151	64	−0.49	176	267	55	−0.33	218	366	53	−0.42
135	17	73	−0.41	177	122	57	−0.64	219	291	93	−0.35
136	452	73	−0.50	178	27	72	−0.19	220	71	0.698	−0.51
137	453	76	−0.31	179	126	79	−0.37	221	292	0.700	−0.31
138	454	80	−0.45	180	237	79	−0.52	222	141	03	−0.59
139	455	83	−0.41	181	268	81	−0.51	223	293	08	−0.37
140	456	86	−0.35	182	90	0.387	−0.46	224	294	18	−0.46
141	457	89	−0.40	183	269	0.422	−0.44	225	92	26	−0.34
142	458	92	−0.41	184	208	32	−0.41	226	295	29	−0.49
143	79	94	−0.18	185	238	46	−0.50	227	109	57	−0.49
144	459	0.195	−0.39	186	86	62	−0.60	228	35	61	−0.40

№	Obs.	τ	Δm	№	Obs.	τ	Δm	№	Obs.	τ	Δm
229	261	$0^d.762$	$-0^m.41$	271	33	$9^d.043$	$-0^m.34$	313	24	$1^d.296$	$-0^m.51$
230	164	63	—0.28	272	20	50	—0.45	314	81	1.320	—0.50
231	167	68	—0.47	273.	206	54	—0.30	315	127	27	—0.50
232	262	74	—0.34	274	335	65	—0.42	316	205	40	—0.43
233	333	74	—0.55	275	336	88	—0.38	317	212	45	—0.61
234	70	77	—0.54	276	48	89	—0.49	318	21	58	—0.72
235	263	82	—0.47	277	337	91	—0.34	319	25	62	—0.41
236	334	82	—0.45	278	338	95	—0.47	320	106	63	—0.44
237	165	88	—0.42	279	207	97	—0.41	321	50	70	—0.52
238	110	97	—0.34	280	339	1.099	—0.65	322	53	81	—0.52
239	296	0.799	—0.60	281	23	1.106	—0.72	323	213	1.393	—0.56
240	72	0.807	—0.44	282	112	06	—0.37	324	107	1.403	—0.54
241	403	08	—0.44	283	340	09	—0.59	325	128	06	—0.41
242	36	18	—0.28	284	117	12	—0.50	326	26	37	—0.38
243	404	18	—0.50	285	341	12	—0.48	327	360	42	—0.49
244	405	30	—0.41	286	342	15	—0.57	328	157	54	—0.42
245	196	35	—0.44	287	343	19	—0.42	329	361	54	—0.33
246	241	39	—0.43	288	344	22	—0.52	330	83	65	—0.49
247	406	43	—0.35	289	345	25	—0.40	331	129	70	—0.42
248	111	45	—0.49	290	123	28	—0.55	332	51	1.474	—0.60
249	407	56	—0.42	291	346	28	—0.47	333	362	1.500	—0.44
250	408	66	—0.39	292	98	38	—0.54	334	3	03	—0.36
251	66	67	—0.56	293	2	52	—0.51	335	132	05	—0.41
252	197	72	—0.40	294	85	61	—0.32	336	102	16	—0.50
253	37	92	—0.33	295	68	66	—0.39	337	248	17	—0.27
254	93	92	—0.22	296	124	73	—0.51	338	34	36	—0.61
255	94	0.895	—0.24	297	80	86	—0.70	339	249	37	—0.40
256	38	0.905	—0.41	298	88	86	—0.55	340	108	38	—0.45
257	198	13	—0.53	299	203	1.192	—0.46	341	82	44	—0.56
258	67	20	—0.47	300	347	1.200	—0.44	342	353	49	—0.33
259	274	39	—0.52	301	64	09	—0.42	343	250	52	—0.48
260	275	48	—0.39	302	348	09	—0.44	344	354	58	—0.40
261	276	54	—0.36	303	22	14	—0.46	345	130	62	—0.44
262	32	59	—0.45	304	399	20	—0.40	346	103	92	—0.50
263	277	66	—0.49	305	125	24	—0.58	347	166	1.596	—0.48
264	278	76	—0.36	306	400	33	—0.36	348	133	1.602	—0.49
265	279	85	—0.41	307	349	43	—0.48	349	134	06	—0.36
266	19	91	—0.34	308	350	54	—0.42	350	251	16	—0.48
267	280	0.998	—0.42	309	49	75	—0.47	351	297	18	—0.52
268	281	1.005	—0.44	310	55	76	—0.51	352	298	25	—0.42
269	97	12	—0.45	311	105	77	—0.45	353	401	26	—0.36
270	282	15	—0.52	312	204	94	—0.55	354	252	28	—0.53

№	Obs.	τ	Δm	№	Obs.	τ	Δm	№	Obs.	τ	Δm
355	135	$1^{d}.632$	$-0^{m}.51$	399	310	$1^{d}.739$	$+0^{m}.13$	443	381	$1^{d}.784$	$+0^{m}.20$
356	299	36	−0.57	400	311	42	+0.08	444	382	86	+0.32
357	402	37	−0.34	401	28	43	−0.01	445	217	87	+0.31
358	209	44	−0.30	402	312	47	+0.02	446	175	88	+0.40
359	136	58	−0.17	403	409	49	+0.15	447	210	88	+0.40
360	4	59	−0.47	404	313	50	+0.13	448	383	89	+0.35
361	84	59	−0.40	405	374	51	+0.04	449	413	89	+0.31
362	137	75	−0.27	406	410	53	+0.11	450	218	90	+0.44
363	104	81	−0.21	407	314	54	+0.15	451	176	91	+0.48
364	193	82	−0.49	408	375	54	+0.26	452	414	92	+0.30
365	253	84	−0.32	409	411	56	+0.04	453	384	93	+0.29
366	194	86	−0.34	410	315	57	+0.19	454	177	94	+0.48
367	254	88	−0.25	411	376	58	+0.14	455	219	95	+0.42
368	195	90	−0.26	412	412	58	+0.16	456	415	95	+0.49
369	255	92	−0.27	413	56	59	+0.18	457	211	96	+0.56
370	138	95	−0.12	414	96	59	+0.11	458	385	96	+0.27
371	256	1.696	−0.26	415	316	61	+0.28	459	144	98	+0.23
372	257	1.700	−0.20	416	377	63	+0.24	460	178	98	+0.41
373	300	05	−0.39	417	168	64	+0.11	461	416	98	+0.36
374	258	07	−0.27	418	199	64	+0.31	462	220	99	+0.48
375	301	07	−0.21	419	317	65	+0.26	463	386	1.799	+0.22
376	73	10	−0.22	420	169	66	+0.19	464	179	1.800	+0.49
377	302	11	−0.02	421	378	66	+0.18	465	42	01	+0.21
378	139	13	−0.21	422	200	67	+0.38	466	417	01	+0.37
379	259	14	−0.17	423	170	69	+0.31	467	387	02	+0.45
380	303	14	−0.03	424	318	69	+0.24	468	221	03	+0.49
381	39	16	−0.11	425	379	70	+0.11	469	180	04	+0.59
382	304	16	−0.13	426	171	72	+0.33	470	418	04	+0.36
383	260	17	−0.14	427	201	72	+0.36	471	58	05	+0.28
384	367	17	−0.07	428	41	73	+0.52	472	388	06	+0.48
385	305	19	−0.14	429	319	73	+0.42	473	323	07	+0.39
386	368	20	−0.17	430	380	73	+0.20	474	419	07	+0.34
387	306	23	+0.02	431	172	75	+0.39	475	222	08	+0.56
388	369	24	−0.13	432	142	76	+0.20	476	43	09	+0.28
389	95	27	−0.12	433	214	76	+0.38	477	389	09	+0.41
390	307	27	−0.07	434	57	77	+0.27	478	181	10	+0.41
391	370	27	−0.06	435	173	78	+0.41	479	324	10	+0.43
392	371	30	+0.02	436	215	78	+0.32	480	420	10	+0.36
393	308	31	−0.18	437	320	78	+0.27	481	223	12	+0.45
394	140	32	−0.04	438	174	81	+0.26	482	325	12	+0.33
395	372	34	−0.03	439	143	82	+0.29	483	390	12	+0.39
396	309	35	+0.14	440	216	82	+0.35	484	421	12	+0.37
397	373	37	+0.12	441	321	82	+0.27				
398	40	39	−0.10	442	322	84	+0.25				

Before we attempted to form normal places and to trace the final curve, a provisional curve was drawn, which satisfied best the written observations. The differences observation minus curve were now taken and the probable errors of a single observation computed. The precision of the observations was found to be different for the lamps Nernst and Osram. Thus the average deviation of one observation was obtained from the curve for the observations 1—192 and 193—484, respectively : $0^m.075$ and $0^m.060$. Consequently the probable errors of one observation are

$$\rho_N = \pm\, 0^m.063; \qquad \rho_o = \pm\, 0^m.051$$

and the corresponding weights

$$p_N = 0.6; \qquad p_o = 1.0$$

Then values of the probable errors derive from two sources:

1. The true inaccuracy of one „comparison of brightness“ of the variable with the comparison star consisting in 16 smoothed comparisons of the brightness of an artificial and a real star.

2. The constant „error of the observation series“ made on single nights. The maximum of the latter error amounted to 0.09. For observations 1—192 and 193—484 we obtained the means 0.045 respectively 0.020. For the deduction of these values only those nights were considered on which not less than 5 observations have been secured.

Supposing that these „errors of night“ which depend on causes unknovn hitherto, follov the law of accidental errors, the following numbers are obtained for the „probable error of one night“.

$$r_N = \pm\, 0.038; \qquad r_o = \pm\, 0.017.$$

Consequenthly the accuracy of one „comparison of brightness“ is characterised by the following probable errors:

$$\rho^1_N = \sqrt{\rho^2_N - r^2_N} = \pm\, 0^m.050; \qquad \rho^1_o = \sqrt{\rho^2_o - r^2_o} = \pm\, 0^m.049.$$

The fact that r_N is twice as great as r_o evidently indicates that the cause of the systematic „errors of the night“ or at least to a great part of them must be sought in the photometer itself.

Nevertheless it may be of some interest to bring them into connection with other factors. R. S. Dugan in his work on R T Persei*) examines their

*) Contributions of the Princeton University Observatory № 1.

relation to the hour angle of the observations, the zenith distance and to the observer's fatigue (in consequence of continual night-work). Our observations which have been investigated in like manner did not give any decisive results. They indicated only that „the errors of the night" might depend on the mean hour angle and just in that sense that they increase with the increasing distance from the meridian, the maximum amounting to $0^m.04$. Even this correction is too uncertain to apply to the observations.

The normal places and the result of the final light-curve

Attention was paid to the following points while combining normal places:

1) that each of them should contain observations made on different nights, in order to diminish the effect of the „errors of the night".

2) that the phases of the observations to be combined did not differ very much.

3) that the weights of the normal places did not differ too much.

But owing to insufficient uniformity of the observations it seems not possible to satisfy rigorously these three conditions.

In all 64 normal places were obtained. The following observations: № 23, 27, 41, 79, 92, 93, 94, 206, 247, 426 were excluded with respect to the above made remarks.

Table III.

Normal places.

№	τ	Δm	p	n	o — c	№	τ	Δm	p	n	o — c
1	$0^d.0035$	$+0^m.41$	6.8	10	$0^m.00$	13	$0^d.1154$	$-0^m.25$	5.2	6	$0^m.00$
2	0.0099	+0.40	8.0	10	0.00	14	0.1232	−0.29	7.6	8	−0.01
3	0.0157	+0.38	8.4	10	0.00	15	0.1437	−0.40	7.6	10	−0.05
4	0.0220	+0.35	8.8	10	−0.01	16	0.1638	−0.41	7.2	8	−0.01
5	0.0288	+0.25	8.4	10	+0.06	17	0.1880	−0.40	6.0	6	−0.02
6	0.0387	+0.22	8.2	9	+0.02	18	0.2045	−0.41	6.2	7	0.00
7	0.0530	+0.10	8.4	10	+0.04	19	0.2422	−0.42	6.8	8	+0.01
8	0.0678	+0.04	4.6	5	+0.02	20	0.2952	−0.39	4.8	6	+0.06
9	0.0785	−0.03	4.8	6	+0.02	21	0.3228	−0.47	4.2	5	−0.01
10	0.0874	−0.12	8.4	10	−0.01	22	0.3446	−0.45	5.0	7	+0.02
11	0.0981	−0.15	4.8	6	+0.01	23	0.3945	−0.49	6.6	8	−0.01
12	0.1080	−0.24	6.8	8	−0.02	24	0.4746	−0.48	5.2	6	+0.01

№	τ	Δm	p	n	o — c	№	τ	Δm	p	n	o — c
25	$0^d.5305$	$-0^m.52$	4.0	6	$-0^m.03$	45	$1^d.4707$	$-0^m.44$	4.4	6	$+0^m.01$
26	0.5750	−0.47	6.2	7	+0.02	46	1.5250	−0.47	4.6	7	−0.03
27	0.6177	−0.49	8.2	9	−0.01	47	1.5787	−0.43	7.0	9	−0.02
28	0.6630	−0.44	6.6	7	+0.02	48	1.6306	−0.44	7.6	8	−0.03
29	0.7212	−0.47	4.2	5	−0.02	49	1.6702	−0.35	4.0	6	−0.02
30	0.7710	−0.44	6.4	8	−0.01	50	1.6880	−0.29	5.0	5	−0.03
31	0.7991	−0.44	5.4	7	−0.01	51	1.7000	−0.25	4.6	5	−0.05
32	0.8330	−0.43	5.0	5	−0.01	52	1.7109	−0.16	4.2	5	−0.01
33	0.8660	−0.42	4.8	6	−0.01	53	1.7171	−0.11	6.6	7	+0.01
34	0.9325	−0.41	5.2	6	+0.01	54	1.7254	−0.07	4.6	5	0.00
35	0.9779	−0.41	5.2	6	+0.02	55	1.7324	−0.02	4.6	5	0.00
36	1.0216	−0.44	3.8	5	+0.01	56	1.7424	+0.05	6.2	7	0.00
37	1.0891	−0.44	6.6	7	+0.02	57	1.7548	+0.14	9.6	10	−0.01
38	1.1157	−0.45	7.2	8	+0.01	58	1.7634	+0.22	6.8	8	+0.01
39	1.1440	−0.48	4.0	6	0.00	59	1.7713	+0.28	8.4	10	+0.01
40	1.1970	−0.49	6.0	8	0.00	60	1.7800	+0.31	8.4	10	−0.02
41	1.2470	−0.45	6.4	8	+0.04	61	1.7883	+0.35	9.2	10	−0.02
42	1.3122	−0.52	4.8	6	−0.03	62	1.7962	+0.40	8.8	10	0.00
43	1.3666	−0.52	3.0	5	−0.04	63	1.8025	+0.40	8.4	10	0.00
44	1.4164	−0.49	3.8	5	−0.02	64	1.8098	+0.40	11.2	12	0.00

These normal places determine the final light-curve which is given at the end of this paper. Normal places are marked by circles.

The form of the curve and its interpretation.

On the drawing the curve is represented in two sections. One of them drawn in the larger scale on the time axis, represents the minimum and the other the brightness of T V Cassiopeiae outside minima.

The duration of the variation of the brightness in minimum is $0^d.36 = 8^h8$. It may be suspected that the brightness increases somewhat faster than it decreases. There is also a slight indication towards a small asymmetry of the curve near minimum. The comparison of points which have the same ordinates and lie on both the branches show that the initial moment in the formula for minima (given on p. 149) requires the correction—$0^d.0032$. In the minimum $\Delta m = + 0^m.400$ this brightness remains constant in course of $0^d.024 = 34^m.5$.

Outside minima it does not remain constant, but the level of the curve keeps on rising slowly and reaches its maximum at about $^1/_4$ P when $\Delta m = - 0^m.492$. After this the brightness of the variable decreases and at $^1/_2$ P the

level of the curve drops to $\Delta m = -0^m.408$. Then the curve rises again and it follows the secondary maximum at $^3/_4$ P after this the intensity subsides. It is necessary to add that the variable was apparently brighter by some thousandth of stellar magnitude at the second maximum than at the first. The full amplitude of the variation of brightness may be put equal $0^m.892$.

The constantly used comparison star BD + 58°.24 was related to BD + 58°.11 = PD. 53 ($6^m.89$) not far from it. The difference of brightness of the two stars amounted to $+1^m.06 \pm 0^m.020$, i. e. the brightness of the comparison star $= 7^m.95$. This gives the following values for T V Cassiopeiae:

Maximum	$7^m.46$
Primary Minimum	8.35
Secondary Minimum	7.54

The now generally adopted eclipse theory was applied to the interpretation of the form of the curve. For all later calculations formulae were used which are given by H. N. Russel in a number of papers published in the Astrophysical Journal.

The curve of the variation of brightness outside the „eclipse“ indicates that the components of a pair have the form of elongated ellipsoids of rotation. Besides that, one has to admit that the side of the satellite which faces the brighter star is brighter than its opposite side.

At $z = 0.175$ and $c = 0.025$ the curve levels itself down and becomes a straight line parallel to the time axis. Maximum at $^1/_4$ P and $^3/_4$ P disappear just as the secondary minimum at $^1/_2$ P. The latter fact shows that one of the components radiates, owing to its surface being illumined and heated by another bright components (radiation effect). For the explanation of the curve of the primary minimum let us admit a dark body eclipsing a bright one. The whole disc of the bright body must be assumed to emit light of uniform intensity. If we should have to allow its getting darker towards the edges, the constant brightness in minimum could not possibly be explained. The amplitude corrected for the influence of ellipticity and the radiation effect is $0^m.759$, consequently the whole system loses, while eclipsed, 0.5029 of its light. The relation of the axes between the dark and the bright ellipsoids becomes

$$k = 0.71$$

So T V Cassiopeiae represents a comparatively rare case of an eclipsing binary, one component of which being brighter, is at the same time also larger. At last we find the half major axis of the larger star (expressed in radius of orbit) and the inclination of the orbit. The curve gives no indications res-

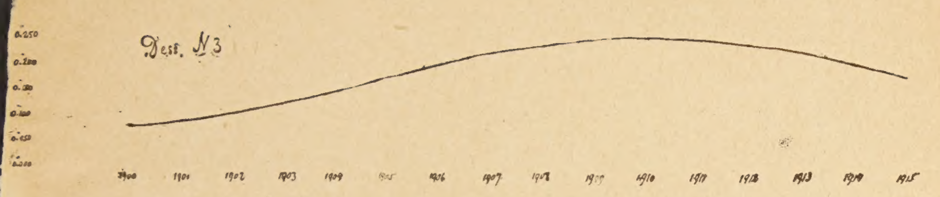
pecting the ellipticity of the orbit; therefore the elements of T V Cassiopeiae are represented as follows:

Half major axis of the bright star	$= 0.35$
„ „ „ „ „ dark star	$= 0.25$
Excentricity of meridian	$= 0.42$
Inclination of the orbit	$= 85^\circ.04$
Period	$= 1^d.812603$

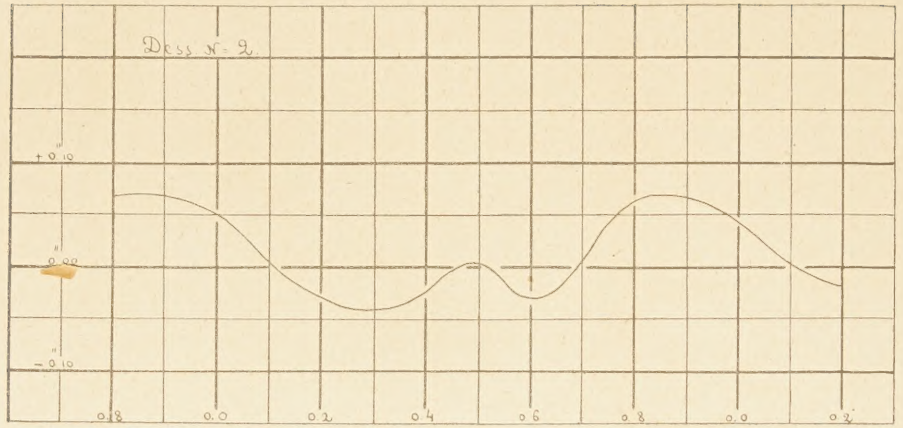
In table III the differences are given between the observed degrees of brightness and those computed from the elements. One may say that the theorical curve generally represents the normal places satisfactorily. Still it is a matter of interest to consider the systematic character of differences near the beginning and the end of the eclipse. Perhaps these discrepancies indicate the presence of some other cause of the variation of the brightness besides those which have been considered.

February, 1915.
Nikolajeff.

Петроградъ. Типографія акц. общ. „С Л О В О“. Ул. Жуковскаго, № 21—23, соб. д.



B. Zemtzoff. Variations de la latitude de Poulkovo de 1904 à 1915.



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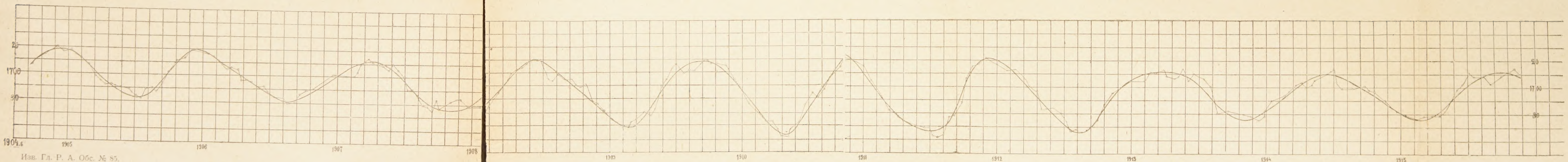

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